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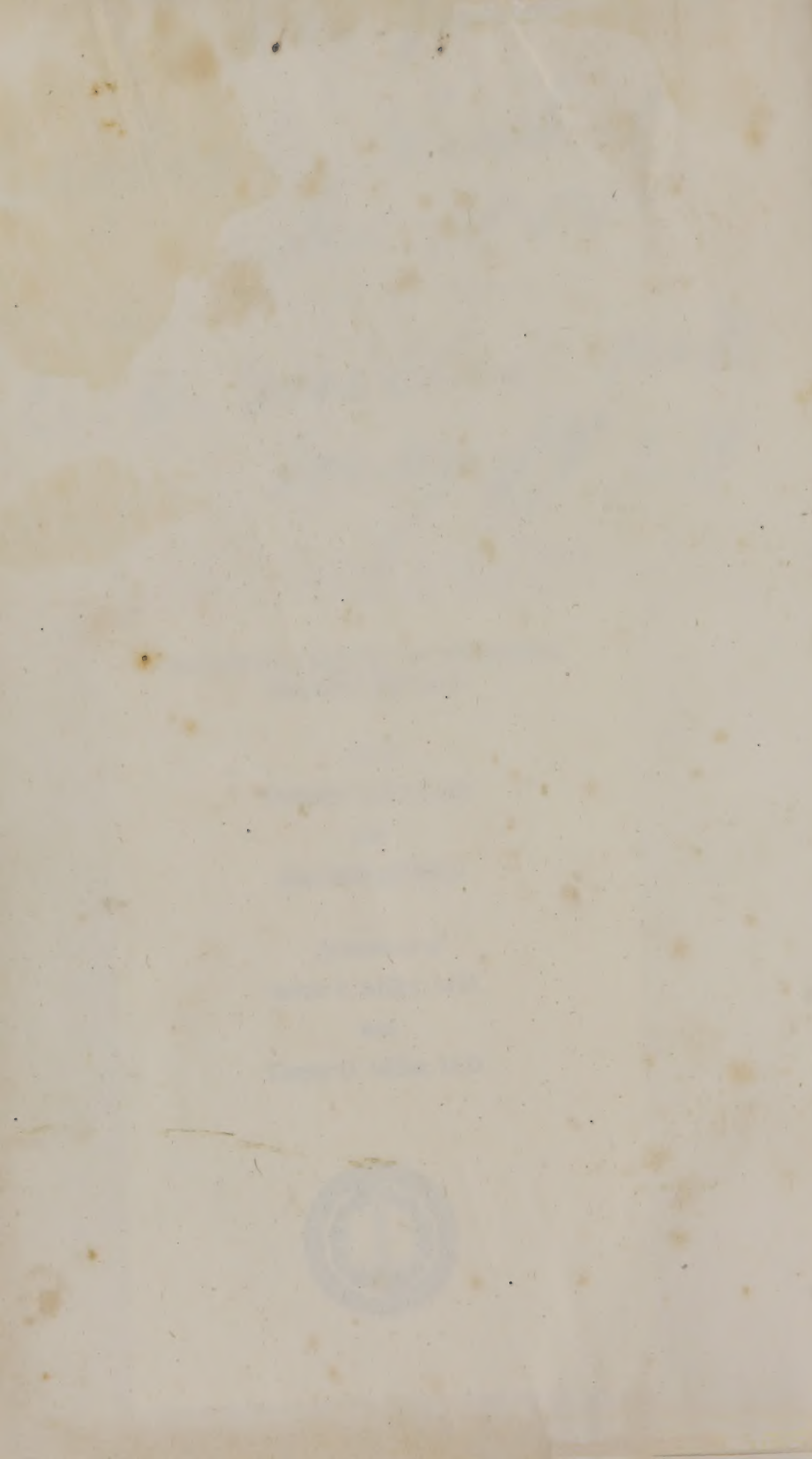
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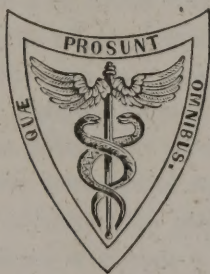




THE
ELEMENTS
OF
MATERIA MEDICA
AND
THERAPEUTICS.
BY
JONATHAN PEREIRA, M.D., F.R.S. & L.S.
THIRD AMERICAN EDITION,
ENLARGED AND IMPROVED BY THE AUTHOR.
INCLUDING NOTICES OF MOST OF THE MEDICINAL SUBSTANCES IN
USE IN THE CIVILIZED WORLD,
AND FORMING AN
ENCYCLOPÆDIA OF MATERIA MEDICA.

EDITED BY
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VOL. II.



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PREFACE TO VOL. SECOND

OF THE AMERICAN EDITION.

THE appearance of the second volume of this work at a considerable period after the publication of the first, would seem to require some explanation other than has been given by the English editors.

As will be perceived from the Preface to the first volume, the author had undertaken a revision of the work so far as it had been printed in England, with especial reference to the American edition. This was performed with respect to three-fourths of the entire Treatise which had been issued, which therefore may be regarded as a fourth edition by him. The remainder has been printed simultaneously with the English edition, the sheets as they were produced being transmitted to the American publishers. A portion of the latter part had undergone the revision of the author himself, but, in consequence of his lamented decease, the residue has been issued under the auspices of the distinguished editors whose preface is appended. The present edition is therefore presented as the last revised work of Dr. Pereira, and the most complete that he published.

With reference to the additions made by the American editor to this second volume, it may be stated that they pertain to the prominent vegetable productions of this country, and to the directions of the United States Pharmacopœia, in connection with all the articles contained in the volume which are referred to by it. Throughout the two volumes now completed, the last revision of the U. S. Pharmacopœia has been referred to, and its directions followed. The illustrations have been materially increased over former editions, and where an opportunity presented of inserting in the American edition more finished representations of plants, it has been done from the abundant resources of the publishers. The additions of the American editor are simply inclosed in brackets [], while those of the English editors have Ed. appended to them.

December 1, 1853.

PREFACE OF THE ENGLISH EDITORS.

THE Second Part of the Second Volume of the *Materia Medica* of the late Dr. Pereira now laid before the profession, brings to a completion the third edition of this valuable work.¹ In executing the difficult task of completing that which had been so ably commenced by the lamented author, the editors have endeavoured to act in accordance with his views, as embodied in a large collection of notes and memoranda which were entrusted to them for this purpose. They have, on their own responsibility, made such alterations and additions as the present state of science appeared, in their judgment, to render necessary; and the changes made in the preparations of the London and Dublin Pharmacopœias since the publication of the previous edition have been duly noticed.

At the time of his decease, the learned author had so far advanced with the present volume as to have completed the description of that important article of the *materia medica*, CINCHONA. The remainder of the volume has passed under the revision of the editors; and it may be proper to state that they have in no case interfered with the views or opinions of the author: but, when circumstances rendered it necessary, they have added, in brackets or in notes, such remarks as appeared to them requisite for the further elucidation of the subject. For some assistance in the performance of this duty, they feel bound to express their obligations to Mr. Jacob Bell and to Mr. Daniel Hanbury. Mr. Bell freely placed at their disposal the numerous papers contributed by the late Dr. Pereira to the pages of the *Pharmaceutical Journal*.

It will be perceived that the present edition of this standard scientific work has assumed an entirely new shape. The Mineral substances of the *materia medica* have been confined to the first, and the Organic substances to the second volume. Considerable additions have been made to both departments: but the Organic *Materia Medica* has been especially enlarged. The additions comprise four hundred pages of new matter; and the articles of *materia medica*, of which a complete medical and scientific history is given, amount to three hundred and sixty. Of the value of the matter thus contributed to the medical literature of the day the Editors feel themselves at liberty to speak, since the author is now no more, and they have

¹ The first part of Volume Second was published in London, before the decease of the author.

merely aided in carrying out his views in one small portion of this elaborate treatise. Their opinion is the expression of the opinion of the whole profession, both in this and foreign countries—namely, that in copiousness of details, in extent, variety, and accuracy of information, and in lucid explanation of difficult and recondite subjects, it surpasses all other works on *Materia Medica* hitherto published. The history of a drug, as it is given in these volumes, is not a dry description of its physical characters and its medicinal uses. Philology, Natural History, Botany, Chemistry, Physics, and the Microscope, are all brought forward to elucidate the subject; and the reader thus acquires a full scientific knowledge of each article of *materia medica* before he is introduced to a description of its effects on plants, animals, and man, or to the various theories of its operation, and the different uses to which it has been applied in ancient and modern times. In illustration of this statement, we refer to Article 232, on *CINCHONA*, the last which passed under the hand of the author. This article, when taken alone, displays an amount of scientific knowledge, a degree of industry in the collection of facts, and a judgment in selecting and describing them, which it is rare to meet with in one individual. In treating of the properties of the *Cinchona* alkaloids, it will be observed that even the abstruse subject of epipolization, or the internal dispersion of light, as a test for quina, has not escaped his notice. It was a peculiar feature in the writings of the author—one which is stamped upon every page of this treatise—that he was not satisfied until he had thoroughly exhausted the subject. His references to ancient and modern writers are constant and numerous; he goes to all sources which are capable of yielding information, and fairly acknowledges his obligations to those by whose learning, experience, or research, he profits. He has thus succeeded in transforming the substance of an unpretending course of lectures into a complete *Encyclopædia of Materia Medica*. We entertain no doubt that the present edition will be found to add to that high reputation which, while living, the author had acquired by his researches in this important branch of medical science.

ALFRED SWAINE TAYLOR.
GEORGE OWEN REES.

LONDON, *September*, 1853.

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Sub-division I.

Perianth absent, squamiform, or glumaceous.

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Sub-division II.

Perianth proper, often corolline.

1. Leaves straight-veined or curved-veined.

† Flowers, sessile, spadiceous.

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EXPLANATION OF PLATE I.

This plate represents the appearance of starch grains when moistened with water, and viewed by a power capable of magnifying 250 diameters. In order that the reader may compare the sizes of the different grains, the micrometer lines are faintly indicated; each of the square spaces between the lines represents the $\frac{1}{1000}$ th part of a square inch.

1. *Wheat Starch*.—Most of the larger particles present their flattened faces to the observer. Three particles, seen edgeways, have a stronger lateral shading. (For a description of the grains, see p. 125.)

2. *Barley Starch*.—As wheat starch. (See p. 115.)

3. *Oat Starch*. (See p. 112.)

4. *Rye Starch*. (See p. 128.)

5. *Maize Starch*.—The upper portion represents isolated grains. The lower portion (a) represents a mass of grains, as seen in the outer or horny portion of the cells, the albumen with the cells *in situ*. (See p. 110.)

6. *Rice Starch*. (See p. 108.)

7. *Sago Meal*. (See p. 163.)

8. *Starch Grains of Pearl Sago*. (See p. 165.)

9. *Starch Grains of False Sago made from Potato Starch*.—One of the grains has escaped the action of the heating process to which they have been subjected; all the others have been ruptured. Chiefly taken from a specimen of Planché's "*Sagou de la Nouvelle Guinée*." (See pp. 166—7.)

EXPLANATION OF PLATE II.

10. *West India Arrow-root (Maranta Arundinacea)*. (See p. 224.)

11. *Portland Arrow-root (Arum)*. (See p. 387.)

12. *East India Arrow-root (Maranta Indica)*. (See p. 224.)

13. *Tous Les Mois (Canna Coccinea)*. (See p. 227.)

14. *Tapioca (Manihot)*. (See p. 381.)

15. *Do.* (See p. 381.)

16. *Starch of the Cycas Circinalis*. (See p. 283.)

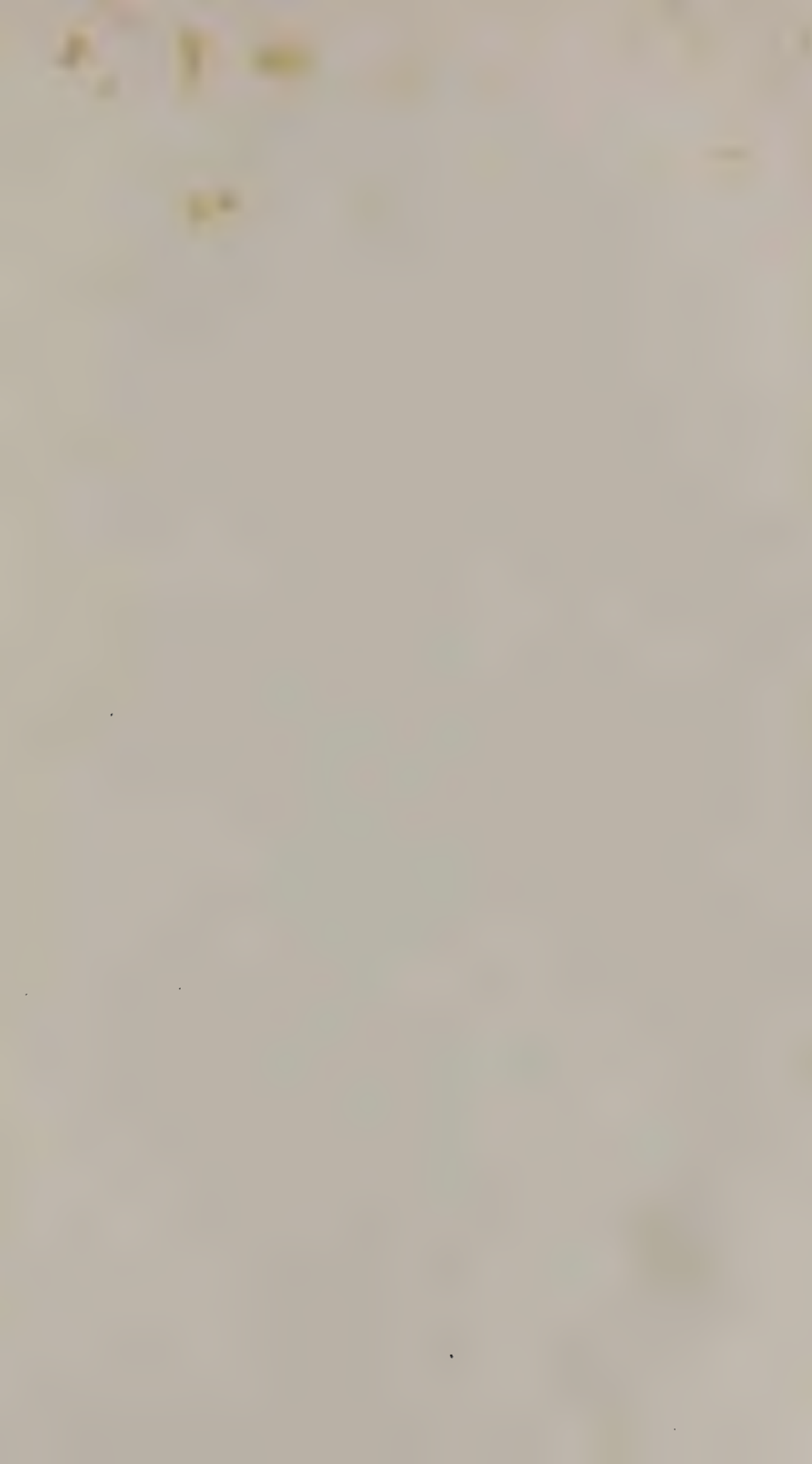
17. *Potato Starch (Solanum Tuberosum)*. (See p. 501.)

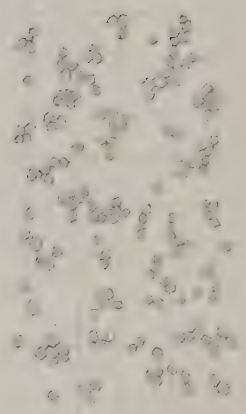
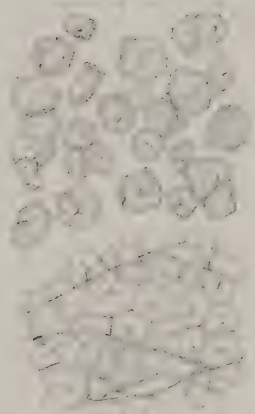
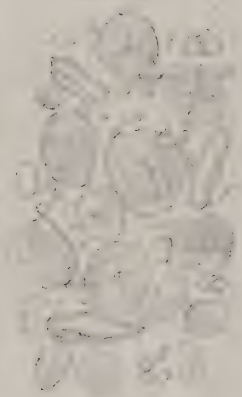
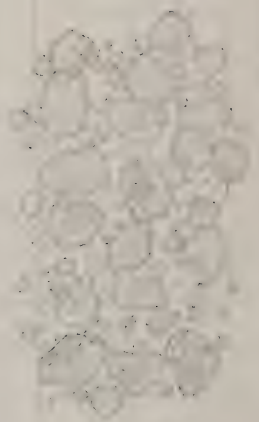
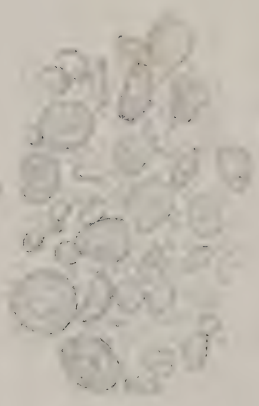
18. *Tahiti Arrow-root (Tacca Oceanica)*. (See p. 221.)

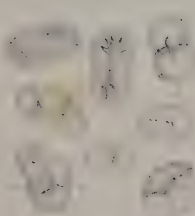
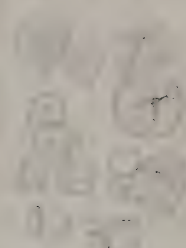
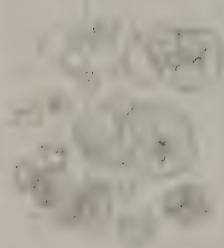
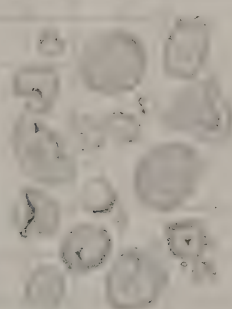
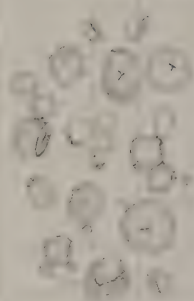
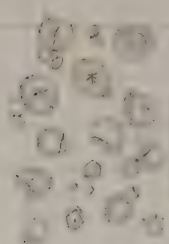
19. *Starch of the Yam (Dioscorea Villosa)*. (See p. 260.)

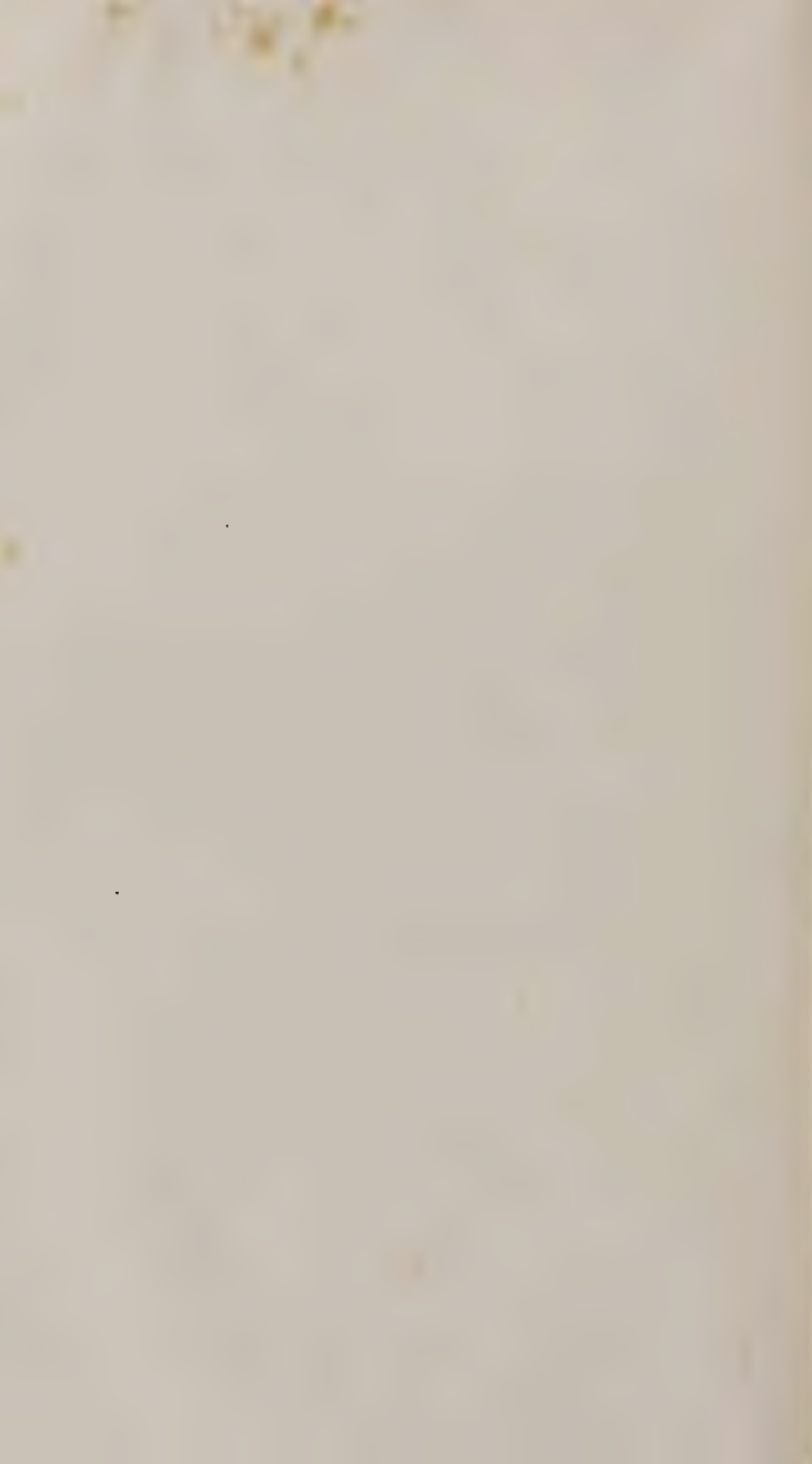
20. *Starch of the Pea (Pisum)*.

21. *Starch of the Plantain (Musa Paradisiaca)*. (See p. 223.)









ELEMENTS

OF

MATERIA MEDICA.

II. ORGANIC BODIES.

UNDER this division are included those vegetables and animals, with their educts and products, which are employed in medicine.

I adopt L. Gmelin's definition of an organic compound, and which I have already stated (see vol. i. p. 291, *foot note*).

For reasons which have been assigned in the Preface to the first volume, certain medicinal compounds, which consist of an organic acid and an inorganic base, have been referred to the first division of this work, which treats of inorganic bodies.

I. Vegetabilia.—Vegetables.

These may be conveniently arranged in four classes, as follows:—

- | | | |
|---|---|--|
| I. <i>Cryptogamia</i> ; acotyledonous, asexual, or flowerless | { Stem and leaves undistinguishable 1. <i>Thallogenæ</i> .
{ Stem and leaves distinguishable 2. <i>Acrogenæ</i> .
{ Cotyledons solitary or alternate; wood of stem youngest in the centre 3. <i>Endogenæ</i> .
{ Cotyledons opposite or verticillate; wood of stem youngest at the circumference . 4. <i>Exogenæ</i> . | |
| II. <i>Phanerogamia</i> ; sexual, or flowering . . | | |

I. Cryptogamia, *Linn.*—Cryptogams or Flowerless Plants.

ACOTYLEDONES, *Jussieu*.—EXEMBRYONATÆ OF ARRHIZÆ, *Richard*; AGAMÆ OR ATHEOGAMÆ, *Auctorum*; NEMÆÆ, *Fries*.

CHARACTERS—*Sexual organs*, and, consequently, *flowers* and true *seeds*, absent. Reproduction taking place either by *spores*, which are enclosed in cases called *thecæ*, or imbedded in the substance of the plants; or else by a mere dissolution of the utricle of cellular tissue. *Spores* destitute of embryo and cotyledons, germinating at no fixed point, but at any part of their surface.

Class I. Thallogenæ.—Thallogens.

ANANDRÆ, Link; ACOTYLEDONEÆ, Agardh; HOMONEMEÆ, Fries; CRYPTOPHYTA, Link; THALLOPHYTA, Endlicher; AMPHIGENÆ, Ad. Brong.

CHARACTERS.—Substance of the plant composed chiefly of cellular tissue, devoid of spiral vessels. Cuticle destitute of stomata, or breathing pores. Stem and leaves undistinguishable. No opposition of stem and root.

This class includes three orders:—

- I. Thallogens nourished through their whole surface by the medium in { Aquatic 1. Algæ.
which they vegetate { Aerial 2. Lichenes.
- II. Thallogens nourished through their thallus (spawn or mycelium)
by juices derived from the matrix 3. Fungi.

ORDER I. ALGÆ, DC.—ALGALS.

ALGALES, Lindley.

CHARACTERS.—Cellular flowerless plants, nourished through their whole surface by the medium in which they vegetate; living in water or very damp places; propagated by zoospores, coloured spores, or tetraspores.

PROPERTIES.—None of the plants of this order are poisonous. Some of them are nutritious, emollient, and demulcent: these properties they owe to the presence of mucilage¹ (carrageenin), starch, sugar (mannite), and a little albumen. The peculiar mucilage of sea-weeds will be more fully noticed hereafter (see *Chondrus crispus*). It differs, says Dr. Stenhouse, from ordinary gum, for, when digested with nitric acid, it yields oxalic, but neither mucic nor saccharic acids.

Mannite is probably obtainable in greater or less quantity from most if not all sea-weeds. It was procured from eight out of nine species examined by Dr. Stenhouse². He could not detect it in *Ulva latissima*. The following is a list of the Algæ which he examined, arranged in order, according to the quantity of mannite which they severally yielded:—

- | | |
|--|--|
| 1. <i>Laminaria saccharina</i> (12.15 per cent. of mannite). | 5. <i>Alaria esculenta</i> . |
| 2. <i>Halidrys siliquosa</i> (5 or 6 per cent.). | 6. <i>Rhodomenia palmata</i> (2 or 3 per cent.). |
| 3. <i>Laminaria digitata</i> . | 7. <i>Fucus vesiculosus</i> (1 to 2 per cent.). |
| 4. <i>Fucus serratus</i> . | 8. <i>Fucus nodosus</i> . |

Fig. 146.



Esulent Sea Weeds.

- | | | |
|--|----------------------------------|------------------------------|
| a. <i>Rhodomenia palmata</i> (or Dulse). | c. <i>Laminaria saccharina</i> . | e. <i>Alaria esculenta</i> . |
| b. <i>Rhodomenia ciliata</i> . | d. <i>Iridæa edulis</i> . | f. <i>Ulva latissima</i> . |

¹ On the Mucilage of the Fuci, with Remarks on its Application to economical ends, by Mr. S. Brown, Jr., in Jameson's *Edinb. New Phil. Journ.* vol. xxvi. p. 409, 1839.

² *Memoirs and Proceedings of the Chemical Society of London* for 1844.

On the first two of these plants, when dried, the mannite often forms crystalline incrustations, which by some have been erroneously supposed to be common salt. Dr. Stenhouse thinks that mannite might be more economically procured from sea-weeds than from manna.

The alterative and resolvent virtues ascribed to sea-weeds, and their presumed beneficial effects in scrofulous affections and glandular enlargements, are referable to the inorganic constituents; such as iodine, bromine, the phosphates, and the alkaline substances. The following table shows the composition and proportion of ash in certain sea-weeds:—

	Laminaria saccharina. North Sea.	Fucus serratus. North Sea.	Laminaria latifolia.	Furcellaria fastigiata.	Chondrus crispus.	Iridaea edulis.	Polysiphonia elongata.	Delesseria sanguinea.	Fucus digitatus. From the mouth of the Clyde.	Fucus nodosus. From the mouth of the Clyde.	Fucus serratus. From the mouth of the Clyde.	Approximate mean.
Potash	24.77	16.02	16.91	21.36	18.00	23.42	21.23	13.72	22.40	10.07	4.51	17.50
Soda	1.84	6.01	..	24.77	19.47	16.06	5.06	21.34	8.29	15.80	21.15	12.70
Lime	6.50	7.05	8.28	6.02	7.11	10.23	2.92	2.30	9.79	10.98	11.09	7.39
Magnesia	8.13	7.59	6.80	11.04	11.80	..	20.56	5.94	7.44	10.93	11.66	9.89
Chloride of sodium	33.72	38.72	26.92	..	..	1.66	13.85	..	28.39	20.16	18.76	16.56
Chloride of potassium . . . . .	..	..	10.18	..	..	..	..	..	..	..	..	0.93
Iodide of sodium	4.70	0.27	..	..	..	..	..	..	3.62	0.54	1.33	0.95
Phosphate of lime	8.41	4.95	12.80	3.96	0.76	23.23	2.99	3.90	5.63	3.34	9.67	7.24
Phosphate of iron	0.75	0.64	..	..	..	..	..	..	..	..	..	..
Oxide of iron . . . . .	..	..	..	..	..	..	..	..	0.62	0.29	..	..
Oxide of manganese . . . . .	..	..	..	0.22	..	..	..	..	..	..	0.34	0.24
Sulphuric acid	10.60	18.35	19.63	32.63	42.86	25.19	28.66	40.42	13.26	26.69	21.06	24.76
Silica	0.58	0.40	0.69	..	..	..	2.83	12.38	1.56	1.20	0.43	1.82
	100 ¹	100 ¹	295.21	100 ²	100 ²	299.79	298.10	100 ²	100 ³	100	100 ³	99.98
Per centage of ash in weed dried at 212° F.	9.78	25.83	13.62	18.92	20.61	9.66	17.10	13.17	20.40	16.19	15.63	16.46

The presence of so large a proportion of potash and phosphoric acid in plants growing in sea-water, which contains so small a proportion of these ingredients, is very remarkable. There is reason, however, to believe that the quantity and constitution of the ash are liable to very considerable variation, depending on the locality, season, age of the plant, &c. A vermifuge property has been ascribed to some algæ.

Laennec⁴ tried the influence of an artificial "marine atmosphere" (air impregnated with the vapour of fresh sea-weed) on consumptive patients, and was impressed with an idea of its efficacy; but experience has not confirmed his favourable opinion of its beneficial influence; moreover, the inhabitants of sea-coasts, like those of inland districts, are the subjects of phthisis.

Sub-order I. CONFERVACEÆ, *Endl.*—CONFERVALS.

CHARACTERS.—Vesicular, filamentary, or membranous algæ, propagated by sporidia (endogenous cells, or a gelatinous substance which is ultimately formed into cells), which are produced at the expense of the endochrome of one or more cells, or sometimes by the copulation of distinct individuals, and discharged by the opening or absorption of the mother cell.

PROPERTIES.—These are similar to those of the Order, and which I have already noticed (see *ante*, p. 50).

1. Confervals of mineral waters.—Confervals are peculiarly abundant in both hot and cold sulphureous springs. *Calothrix nivea* (Fig. 147), the *Conferva nivea* of Dillwyn,⁵ has been found in the sulphur springs of Yorkshire, Durham, and Aix-la-Chapelle.⁶ The same, or an allied species, was found by Dr. Daubeny⁷ in the hot sulphur springs of Greoulx, in Provence. *Oscillaria labyrinthiformis*—the *Tremella thermalis* of some writers—is one of the most common species in the hot sulphur springs, and other thermal waters of Germany, France, and

¹ Schweitzer.

² Forchhammer.

³ Gödechens, *Annal. der Chemie und Pharm.* liv. p. 352.

⁴ *Treat. on Diseases of the Chest*, by Dr. Forbes, p. 369.

⁵ *British Confervæ*, p. 54.

⁶ Daubeny, *Linn. Trans.* vol. xvi. p. 597, 1831.

⁷ *Op. citato*.

Italy. In the Karlsbad waters, *Sphærozyga Jacobi* (Fig. 148), and several species of *Oscillaria*, have been detected.¹ Humboldt found *Oscillaria calida* in the thermal waters of New Granada.

Fig. 147.

*Calothrix nivea.*

Fig. 148.

*Sphærozyga Jacobi.*

The organic substance found in mineral waters, and variously called *barégine* by Longchamp, *zoogen* by Gimbernat, *theiothermin* by Monheim, and *glairine* by Anglada, derives its origin from confervals. It is a glairy or mucus-like substance, which is said to communicate the flavour and odour of flesh-broth to the water in which it is contained. In the preparation of artificial sulphur baths, animal gelatine is sometimes used to represent the *barégine* (see *ante*, vol. i. p. 478).

The confervals, under the influence of light, decompose water, retain the hydrogen, and evolve the oxygen. Robiquet² obtained, from the Nérès water, gas containing 44 per cent. of oxygen, derived from the *Oscillatoria labyrinthiformis*; and he ascribed the medicinal qualities of these waters to the presence of this very oxygenated air. "Dr. Edwards," says Robiquet, "has shown that the air contained in water has a great influence over the life of batrachians, and it is probable that, in some cases, our organs may also be more or less influenced by it."

2. Confervals employed in medicine.—Yeast is referred to Algæ by Kützing,³ who calls it *Cryptococcus Fermentum*. It is more commonly, however, regarded as a fungus, and as such

Fig. 149.

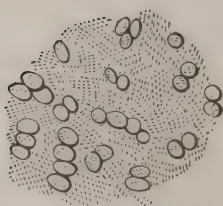
*Cryptococcus inæqualis*
(in aqua calami).

Fig. 150.

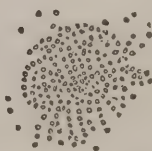
*Ulvina myxophila*
(in mucilage of quince seed).

Fig. 151.

*Hygrocrocis cuprica*
(in a solution of polychrome mixed with sulphate of copper).

will be noticed hereafter. (See *Fungi*.) With this doubtful exception, none of the Confervals are employed, at the present day, in medicine. *Nostoch commune*, or star-jelly, of which, formerly,

¹ Endlicher, *Genera Plant.* Supp. 3me; Geiger's *Handb. d. Pharm.* 2te Aufl. Ergänzsheft, 1813.

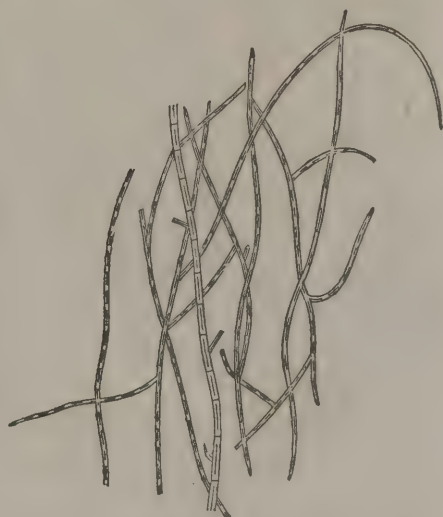
² *Journ. de Pharmacie*, t. xxi. p. 589, 1835.

³ *Phycologia generalis*.

the most extraordinary superstitions were entertained,¹ and *Conserva rivularis*, or crow silk, recommended by Murray² for trial in asphyxia, asthma, and phthisis, on account of its evolving oxygen in solar light, have never been used in rational medicine.

3. Confervals developed in pharmaceutical and other liquids.—The vesicular and filamentous plants which grow in various chemical solutions,³ and to the naked eye appear like gelatinous or cottony masses, are considered by some botanists to be Algals. Kützing refers them to the genera *Cryptococcus*, *Ulvina*, *Hygrocrocis*, *Sirocrocis*, *Leptomitius*, and *Chamænema*.

Fig. 153.



Leptomitius phosphoratus
(in phosphoric acid from bones).

Fig. 152.



Sirocrocis stibica
(in a solution of emetic tartar).

But these minute plants are regarded by some eminent authorities as the spawn or mycelium of various moulds, or, in other words, as imperfect mucedinous fungi. "It is true," says the Rev. M. J. Berkeley, "that moulds will vegetate in fluids, but, as soon as they assume their normal form, there is a distinction between the immersed and free portion." If, however, they fructify under water, which, according to Kützing, they do, their algaecious nature is, I apprehend, proved.

4. Esculent Confervals.—Some few of the Confervals are cooked and brought to table under the name of *laver*; but the amount of nourishment which they contain is very small. They are species of *Porphyra* and *Ulva*.

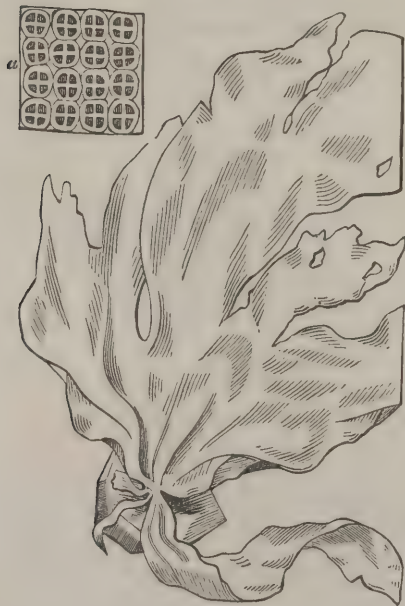
¹ See the articles "*Nostock*," in the *Dict. Univ. de Mat. Méd.* t. iv. p. 635, 1832; and "*Califolium*," in James's *Medicinal Dictionary*, vol. ii.

² *Appar. Medicaminum*, t. v. p. 550, 1790.—Pliny (*Hist. Nat.* lib. xxvii. cap. 45) says he knew a labourer who fell from the top of a tall tree, and thereby broke nearly every bone in his body, and who, being covered with a river conferva, kept moist by his own water, was cured in an incredibly short space of time. He adds, that the term *conserva* is derived from "*conferruminando*," in allusion to the supposed consolidating properties of this plant.

³ For some notices of these plants, the reader is referred to my paper *On the Microscopic Vegetations developed in Pharmaceutical Liquids*, in the *Pharmaceutical Journal*, vols. vii. and viii. 1848.

1. *Porphyra laciniata*, Agardh.—Laciniated Purple Laver.

Fig. 154.

*Porphyra laciniata*.

a. Small portion of the frond, showing the quaternate granules (magnified).

2. *Ulva latissima*, Greville.—Broad Green Laver.

Ulva Lactuca var. *latissima* Lightf; *Green Sloke*; *Oyster Green*.—The fronds are bright herbaceous green, becoming tinged with brown in old age and decay. They are oblong or roundish, waved, and very tender (see Fig. 146, f). The granules are quaternate, and densely cover the whole frond. It is said to be used at table under the name of *green laver*, being cooked in the same way as the *Porphyra laciniata*, to which it is greatly inferior. It is rarely taken when the latter can be procured. I have never found it in the London shops.

Sub-order II. PHYCÆ, Endl.—SEA WRACKS.

FUCACEÆ, Lindl; APLOSPORÆ, Decaisne.

CHARACTERS.—Cellular or tubular algals propagated by spores (endogenous cells), contained in superficial, often bladdery (*utricle*s) cells, produced singly out of endochrome, consisting of a simple nucleus clothed by its proper cellular membrane (*epispore*), and discharged by the opening of a transparent mother cell (*perispore*).

PROPERTIES.—Similar to those of the order (see *ante*, p. 50). To this order several esculent species belong: such as *Limnaria digitata*, called by the English *sea-girdles*, by the Scotch *Tangle*; and *Alaria esculenta* (Fig. 146, e), termed *Badderlocks*, *Hen-ware*, or *Honey ware*. These, as well as several other species of this order, viz., *Laminaria saccharina* (Fig. 146, c), and *Halidrys siliquosa*, have been already referred to as containing mannite (see *ante*, p. 50).

The only species used for medicinal purposes which it will be necessary to notice is *Fucus Vesiculosus*.

¹ Harvey, *Phycologia Britannica*, vol. 1. pl. xcii. 1846.

3. FUCUS VESICULOSUS, Linn.—COMMON SEA WRACK.

Sez. Syst. Cryptogamia, Algæ.

(Herba cum fructu, Offic.)

HISTORY.—Theophrastus¹ mentions several species of Algæ (φῦκος). *Fucus vesiculosus* is sometimes termed *quercus marina*, *bladder fucus*, and *common sea-ware*, *kelp-ware*, and *black tang*.

BOTANY. **Gen. Char.**—*Frond* linear, either flat, compressed, or cylindrical, dichotomous (rarely pinnated), coriaceous. *Air-vessels* [*vesiculæ*] when present innate, simple. *Receptacles* either terminal or lateral, filled with mucus, traversed by a net-work of jointed fibres, pierced by numerous pores, which communicate with immersed spherical *conceptacles*, containing parietal spores, or *antheridia*, or both (Harvey).

Sp. Char.—*Frond* plane, linear, dichotomous, entire at the margin. *Air-vessels* roundish-oval in pairs. *Receptacles* mostly elliptical, terminating the branches (Greville).

Very variable; but the varieties pass so insensibly into each other that it is difficult to define them strictly.

Hab.—Sea-shores. Very common everywhere.

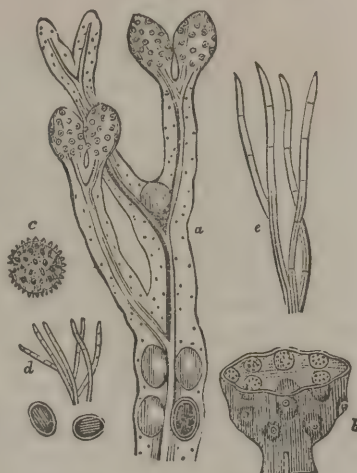
PHYSICAL PROPERTIES.—Its substance is thickish, flexible, but very tough. Its colour is dark, olivaceous, glossy green, paler at the extremities, and becomes black by drying. Its odour is strong; its taste nauseous.

COMPOSITION.—It has been analyzed by Stackhouse,² by Gaultier de Claubry,³ by John,⁴ and by Fagerstrom.⁵ The following appear to be its constituents: *Cellulose*, *mucilage* (carrageenin), *mannite*, *odorous oil*, *colouring* and *bitter matters*, and various salts.

The following table shows the composition and proportion of ash of *Fucus vesiculosus* of different localities:—

	Mouth of the Clyde.	Mouth of the Mersey.	North Sea.	Denmark.	Greenland.	Mean.
Potash	15.23		17.68	9.03	17.86	11.96
Soda	11.16	15.10	5.78	7.78	21.43	12.25
Lime	8.15	16.77	4.71	21.65	3.31	10.92
Magnesia	7.16	15.19	6.89	10.96	7.44	9.53
Chloride of sodium . . .	25.10	9.69	35.38	3.53	25.93	19.62
Iodide of sodium . . . }	0.37		0.13			0.25
Phosphate of iron and phosphate of lime . . }	2.99		5.44	9.67	10.09	5.64
Oxide of iron	0.33	4.42				0.95
Sulphuric acid	28.16	30.94	23.71	26.34	13.94	24.62
Silica	1.35	7.69	0.28	11.04		4.06
	100 ⁶	100 ⁷	100 ⁸	100 ⁹	100 ⁹	100
Per centage of ash (cal- culated dry)	16.39	13.22	20.56		16.22	16.60

Fig. 155.

*Fucus vesiculosus*.

a. Upper part of a frond, with air vessels and receptacles.

b. Section of a receptacle.

c. Conceptacle.

d. Filaments and spores, of which the conceptacles are composed.

e. Filaments which issue from the pores on the surface of the frond.

¹ Hist. Plant. lib. iv. cap. vii.² Ann. Chim. xciii. 116.³ Gmelin, Handb. d. Chem. Bd. ii. S. 1354.⁴ Godechens, Annal. der Chemie und Pharm. liv. p. 532.⁵ Schweitzer.⁶ Dict. Scien. Nat. xviii. 500.⁷ Schweigger's Journ. xiii. 464.⁸ James, *ibid*.⁹ Forchhammer.

CHEMICAL CHARACTERISTICS.—By treating the distilled water of *Fucus vesiculosus* with ether, a *semi-solid white oil* is extracted, which is the odorous principle. The aqueous decoction of this plant is neutral, and contains in solution mucilage (see carrageenin) and various salts. It yields, with chlorine and starch, faint traces only of iodine, sometimes none at all. But if alcohol be added, by which the mucilage and a part of the sulphates are thrown down, the alcoholic liquor evaporated, and the residue mixed with potash, then calcined, and afterwards treated with hydrochloric acid to disengage hydrosulphuric acid, we may sometimes detect iodine in the filtered liquor by the deep blue colour formed on the addition of starch and chlorine.¹

By combustion in the open air, this plant yields the ash called *kelp*; and by incineration in a covered crucible it gives a charcoal, termed *vegetable ethiops*.

PHYSIOLOGICAL EFFECTS.—During the winter, in some of the Scottish islands, horses, cattle, and sheep are fed on it.² Its local action is detergent, and, perhaps, discutient. Its remote effects are probably analogous to those caused by small doses of iodine, modified by the influence of salts of sodium and calcium.

USES.—Frictions of the plant, with its contained mucilage, were employed, with supposed advantage, by Dr. Russell,³ in glandular enlargements and other serofulous tumours: the parts were afterwards washed with sea water. He also gave internally the expressed juice of the vesicles in glandular affections.⁴

ÆTHIOPS VEGETABILIS; Vegetable Ethiops.—This is prepared by incinerating *Fucus vesiculosus* in a covered crucible. It is composed of charcoal and various salts (see *supra*). When hydrochloric acid is added to it, traces of sulphuretted hydrogen are frequently evolved. By digesting the ethiops in water, and testing the solution with nitric acid and starch, I have sometimes failed to obtain the blue colour indicative of the presence of iodine. It has been exhibited in bronchocele and serofulous maladies. Dr. Russell⁵ says it far exceeds burnt sponge in virtue. It has been employed also as a dentifrice. The dose of it is from ten grains to two drachms.

Sub-order III. FLORIDEÆ, *Endl.*—ROSE-TANGLES.

CERAMICEÆ, *Lindl.*; CHORISTOSPOREÆ, *Dcaisne*.

CHARACTERS.—Cellular or tubular algae propagated by thecæ (*favellæ* vel *favellidia*, *coccidia* vel *keramidia*), composed of granules [spores?] contained within a cellular or gelatinous perisporangium; and by sphaerospores (or *tetraspores*), composed of four (or three) spores in a transparent perispore.

PROPERTIES.—Several species of this sub-order are esculent. They owe this property to the mucilage, starch, mannite, and perhaps a little albumen, which they contain. Besides the species presently to be described, *Iridæa edulis* (Fig. 146, d) and *Rhodomenia palmata* (Fig. 146, a), which is cried about the streets of Edinburgh under the name of *dulse*, may be mentioned as illustrative examples of esculent species.

4. CHONDRUS CRISPUS, *Grev.*—CARRAGEEN OR IRISH MOSS.

Sex. Syst. Cryptogamia, Algæ.
(*Planta, Offic.*)

SYNONYMES.—*Chondrus polymorphus*, Lamour; *Sphærococcus crispus*, Agardh; *curled chondrus* (chondrus, from *χόνδρος*, cartilage).

HISTORY.—*Carrageen*, *Irish*, or *pearl moss*, was introduced into medicine by Mr. Todhunter, of Dublin.⁶

BOTANY. Gen. Char.—*Fronde* cartilaginous, nerveless, compressed or flat, flabelliform, dichotomously cleft: formed internally of three strata; the *inner*, of

¹ Guibourt, *Hist. des Drog.* 4me éd. ii. 46.

² *Dissertation on the Use of Sea Water*, 5th ed. 1769, pp. 41 and 44.

³ *Op. cit.* p. 98.

⁴ *Reece's Monthly Gazette of Health*, Jan. 1831.

⁵ Greville, *Algæ Brit.* xx.

⁶ *Op. cit.* p. 99.

densely-packed longitudinal fibres; the *medial*, of small roundish cells; the *outer*, of vertical, coloured, moniliform filaments. *Fructification*: 1, prominent *tubercles* (*nemathecia*) composed of radiating filaments, whose lower articulations are at length dissolved into *spores* (?); 2, *tetraspores* collected into sori, immersed in the substance of the frond (*Harvey*).

Sp. Char.—*Frond* stipitate, thickish, cartilaginous, flat or curled, segments wedge-shaped, very variable in breadth; apices truncate, submarginate, or cloven: axils obtuse; sori elliptical or oblong, concave on one side (*Harvey*). *Fronds* from 2 or 3 to 10 or 12 inches long: their substance cartilaginous, in some varieties approaching to horny, flexible and tough; their *colour* deep, purple-brown, often tinged with purplish-red, paler at the summit, becoming greenish, and at length white in decay.

This, says Dr. Greville, is the *Proteus* of marine Algæ. The varieties are innumerable, and pass into one another so insensibly that it is almost impossible to define them.

Mr. D. Turner¹ enumerates the following varieties:—

β. *virens*; frond submembranaceous, branches dilated upwards, flattish, extreme segments long and acuminate.

γ. *stellatus*; frond submembranaceous, branches dilated upwards, divided at their apices into very numerous clustered short laciniae.

δ. *equalis*; frond cartilaginous, thick, all the branches equal, linear, the extreme segments obtuse.

ε. *filiformis*; frond cartilaginous, subcylindrical, branches nearly linear, apices long and acuminate.

ζ. *patens*; fronds subcartilaginous, channelled on one side, dichotomous, angles of the dichotomies patent.

η. *lacerus*; frond cartilaginous, compressed, apices very narrow, elongated, branched.

θ. *sarniensis*; frond between coriaceous and cartilaginous, branches slightly channelled on one side, dilated upwards, apices rounded and emarginate.

ι. *planus*; frond subcoriaceous, flat, wide, branches linear, apices obtuse.

κ. *geniculatus*; frond cartilaginous, compressed, branches nearly linear, tubercles subglobose, black, frond bent, and often broken at the tubercles.

According to Ormancey,² carrageen is a zoophyte which he proposes to call *Antipathes polymorphus*. Unlike the fuci, he says, it has no canal, nerves, or roots; but, like the zoophytes, it has voluntary motion of tentaculae, sensibility, and two distinct bodies, one secreted by the other, simulating a plant.

Hab.—On rocks and stones on the sea-coast; very common.—Perennial: spring.

PREPARATION.—For dietetical and medicinal uses, it is collected on the west coasts of Ireland (especially in Clare), likewise, according to Kohl,³ in Antrim; washed, bleached (by exposure to the sun), and dried.

In Ireland, it is sometimes employed by painters and plasterers as a substitute for size.

Fig. 156.

*Chondrus crispus.*

1. Plant with sori (natural size).
2. Segment with sorus.
3. A segment and sorus vertically divided.
4. Seeds or spores.
5. Tetraspores from the sorus (magnified).

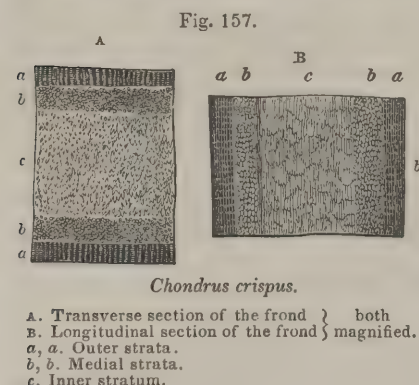
¹ *Fuci; or, Figures and Descriptions of the Plants referred by botanists to the genus Fucus*, Lond. 1808—12, 4to.

² *Journal de Pharmacie et de Chimie*, 3me sér. t. xii. p. 265, 1847.

³ *Ireland*, p. 247.

Along with *Chondrus crispus*, other allied species, especially *Ch. mamillosus*, are sometimes collected (see Fig. 158).

PHYSICAL PROPERTIES.—The carrageen or Irish moss of commerce (*muscus carragenicus*) consists of fronds, which are usually from two to three or four inches long, dry, crisp, mostly yellowish or dirty white, but intermixed with purplish red portions, inodorous, or nearly so, with a mucilaginous taste. The frond is formed internally of three strata; the inner, of densely-packed longitudinal fibres; the medial, of small roundish cells; the outer, of vertical, coloured, moniliform filaments.¹



Chondrus crispus.

- A. Transverse section of the frond } both
B. Longitudinal section of the frond } magnified.
a, a. Outer strata.
b, b. Medial strata.
c. Inner stratum.

Fig. 158.



Chondrus mamillosus.

Portion of the channelled frond bearing the pedicellate capsules.

<i>Herberger.</i>	
Vegetable jelly [carrageenin]	79.1
Mucus	9.5
Two resins	0.7
Fatty matter and free acids	traces
Chlorides of sodium and magnesium	2.0
Fibre, water, and loss	8.7
No traces of iodine or bromine could be recognized.	
	100.0

<i>Feuchtwanger.</i>	
Jelly	{ Pectin [carrageenin] (a large portion). Starch.
	Oxalate of lime.
	Compounds of sulphur, chlorine, and bromine.
	No fungic, boletic, or lichenic acids.

Subsequently, iodine has been detected in it by Sarphati,⁵ and both iodine and bromine by Grosse.⁶ (For the composition of the ashes, see p. 51.)

CARRAGEENIN.—The mucilaginous constituent of carrageen moss is termed by some writers *vegetable jelly*, or *vegetable mucilage*, by others *pectin*. It appears to me to be a peculiar modification of mucilage, and I shall, therefore, call it *carrageenin*. It is soluble in boiling water, and its solution forms a precipitate with diacetate of lead and silicate of potash, and, if sufficiently concentrated, gelatinizes on cooling. Carrageenin is distinguished from ordinary gum by its aqueous solution not producing a precipitate on the addition of alcohol; from starch, by its not assuming a blue colour with tincture of iodine; from animal jelly, by tincture of nut-galls caus-

¹ *Phycologia Britannica*, vol. i. pl. lxiii. Lond. 1846.

² See, also, Henschel in Dierbach, *Die neuesten Entdeck. in d. Mar. Med.* Bd. ii. S. 276, 1843.

³ *Buchner's Repertorium*, Bd. xlix. S. 200, 1834.

⁴ *American Journal of Sciences and Arts*, xxvi.

⁵ *Pharmaceutisches Central Blatt für 1839*, S. 159.

⁶ *Commentatio de Iodio*, Lugd. Bat. 1835.

ing no precipitate;¹ from pectin, by acetate of lead not throwing down anything, as well as by no mucic acid being formed by the action of nitric acid.

According to Schmidt,² the cell-walls of carrageen do not essentially differ from the contents of the cells; for, when the plant is boiled in water, the whole swells up and forms a mucilage, which may be expressed through a linen cloth, leaving behind the *Flustræ* and small crustaceans with which this alga is covered. By digestion for a short time with dilute sulphuric acid in a water-bath, the whole plant is converted into sugar and gum.

The composition of carrageenin dried at 212° F., according to Schmidt, is represented by the formula $C^{12}H^{10}O^{10}$; so that it appears to be identical with starch and sugar. Mulder,³ however, represents it by the formula $C^{24}H^{19}O^{19}$.

CHEMICAL CHARACTERISTICS.—The presence of carrageenin in the decoction is demonstrated by the tests before enumerated. No iodine is recognizable by nitric acid and starch. Oxalate of ammonia detects lime (or calcium) in solution, while nitrate of silver points out the presence of chlorine. Guibourt⁴ could recognize neither sugar nor magnesia.

PHYSIOLOGICAL EFFECTS.—Carrageen moss is nutritive: its mucilaginous matter acts as an element of respiration (see *ante*, vol. i. p. 116), while its inorganic constituents (phosphate of lime, potash, salts, &c.) may also serve some useful purpose in the animal economy. It is generally regarded as being readily digestible.

Medicinally, it is emollient and demulcent (see *ante*, vol. i. pp. 207–8).

USES.—It is a popular remedy for pulmonary complaints (especially those of a phthisical character), chronic diarrhoea and dysentery, scrofula, rickets, enlarged mesenteric glands, irritation of bladder and kidneys, &c. As a culinary article, it has been employed as a substitute for animal jelly, in the preparation of *blanc-mange*, jellies, white soup, &c. A thick mucilage of carrageen scented with some prepared spirit is sold as *bandoline*, *fixature*, or *clysphitique*, for stiffening the hair and keeping it in form.

ADMINISTRATION.—It is usually exhibited in the form of decoction or jelly. It has also been employed in combination with chocolate or cocoa.

1. DECOCTUM CHONDRI; Decoction of Carrageen or Irish Moss.—Macerate half an ounce of carrageen in cold or warm water, during ten minutes; then boil in three pints of water for a quarter of an hour. Strain through linen. When properly flavoured, it may be used as a *tisan* or common drink. By doubling the quantity of carrageen, a *mucilage* (*mucilago chondri*) is procured. Milk may be substituted for water when the decoction is required to be very nutritious. A preparation of this kind has been called *lac analepticum*. Sugar, lemon-juice, tincture of orange-peel, essence of lemon, or other aromatics, as cinnamon or nutmeg, may be employed as flavouring ingredients.

2. GELATINA CHONDRI; Carrageen Jelly.—This may be prepared by adding sugar to the strained decoction and boiling down until the liquid is sufficiently concentrated to gelatinize on cooling; or by employing a larger quantity of carrageen. If milk be substituted for water, *carrageen blanc-mange* is obtained. Sugar and other flavouring ingredients may be employed, as above mentioned.

3. PASTA CACAO CUM CHONDRO; Pasta Cacao cum Lichene Carragheni, Ph. Dan.; *Carrageen Cocoa*.—The Danish pharmacopœia gives the following directions for its preparation: Roasted and decorticated Cacao Seeds reduced to a very subtile mass in a warm iron mortar; Powdered White Sugar, of each ℥ij; Powdered Carrageen ℥iij. Mix, and form into quadrangular sticks. Clarus and Radius⁵ direct *carrageen*, or *white chocolate*, to be prepared as follows: Cocoa Paste ℥iv; Powdered Carrageen ℥vj; White Sugar ℥iv; Flour q. s. (℥vj). Mix.—These pastes are to be used like common cocoa or chocolate.

¹ Berlin. Jahrb. xxxiv Abth. i. 1834.

² Ann. der Chemie u. Pharm. Bd. li. S. 29, 1844.

³ Pharmaceutisches Central Blatt für 1838, S. 500; and The Chemistry of Animal and Vegetable Physiology, by Fromberg and Johnston, Part ii. p. 239.

⁴ Journ. de Chim. Méd. viii. 663.

⁵ Dierbach, Die neuesten Entdeck. in d. Mat. Med. Bd. ii. S. 276, 1843.

5. PLOCARIA CANDIDA, Nees.—CEYLON MOSS.

Sec. Syst. Cryptogamia, Algæ.

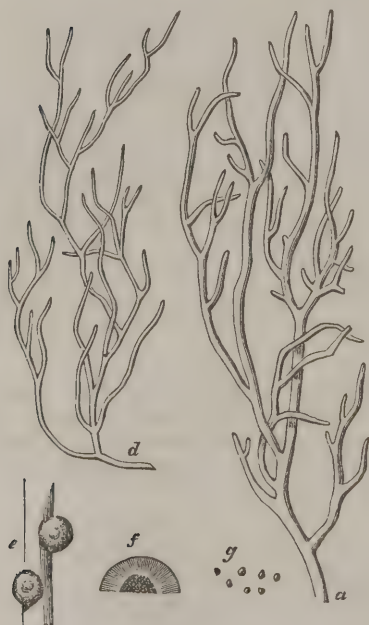
(Planta, Offic.)

SYNONYMES.—*Gracilaria lichenoides*, Greville; *Sphærococcus lichenoides*, Agardh; *Gigartina lichenoides*, Lamouroux; *Fucus lichenoides*, Turner; *Fucus amylaceus*, O'Shaughnessy; *Jaffna Moss*; *Edible Moss*.—According to Rumphius, it is called by the Malays *Sajor carang* and *Agar agar carang*; at Amboyna, it is termed *Aysana* and *Aytsana* (h. e. *arbuscula ramosa*), and *Rumeyar waccar*; at Java, *Bulung*; at Macassar, *Dongi dongi*; and at other places, *Lottu lottu* and *Collocane*.

HISTORY.—It seems to have been long known and used in the East. It has been described by Rumphius,¹ Gmelin,² Turner,³ Nees,⁴ and Agardh.⁵ About the year 1837 it was introduced into England by Mr. Previté; and in the year 1840 public attention was drawn to its useful properties by Messrs. Sigmond and Farre.⁶

BOTANY. Gen. Char.—*Frond* composed of large oblong-cylindrical cells containing granular endochrome, those of the surface forming moniliform, densely-packed filaments. *Fructification* of two kinds: 1. hemispherical, pointed *coccidia*, containing a glomerule of oblong spores on a central placenta, within a pericarp of moniliform, densely crowded filaments; 2. oblong *tetraspores* imbedded in cells of the surface (*Endlicher*).

Fig. 159.

*Plocaria candida*.a. *Plocaria candida* (nat. size).d. Variety *β. edulis*.

e. Part of frond with the coccidia (magnified).

f. Section of coccidium.

g. Spores.

Sp. Char.—*Frond* cartilaginous, cylindrical, filiform, much and irregularly branched; branches smooth, spreading, acute, somewhat fastigiata. *Coccidia* sessile, scattered.

Rumphius mentions four kinds of *Alga coralloides*, which he distinguishes as the *prima*, *secunda*, *tertia*, and *quarta*; and he has figured three kinds. Nees figures two plants—one fertile, the other sterile. Turner notices two varieties: *β edulis* is a smaller variety, and has a remarkably flexuose frond, more thin and less branched than *α*: its colour is quite white.

Hab.—Ceylon, at Jaffnapatam; the islands of the Indian Archipelago.

COMMERCE.—It is exported to China by the islands of the Indian Archipelago. Mr. Crawford⁷ says that it forms a portion of the cargoes of all the junks; the price on the spot where it is collected seldom exceeding from 5s. 8d. to 7s. 6½d. per cwt. The Chinese use it in the form of jelly with sugar, as a sweetmeat, and apply it in the arts as an excellent paste. The gummy matter which they employ for covering lanterns, varnishing paper, &c., is made chiefly, if not entirely, from it.

PHYSICAL PROPERTIES.—Ceylon moss is in whitish or yellowish-white ramifying filaments of several inches in length. At the base the largest fibres do not exceed in thickness a crowquill; the smallest fibres are about as thick as fine sewing thread. To the naked eye the filaments appear al-

¹ *Herb. Amboin*, Pars vi. lib. xi. cap. lvi. p. 181; *Alga coralloides*, tab. lxxvi. 1750.² *Hist. Fucorum*, p. 113, 1763.³ *Hort. physie. Berol.* 42, t. vi.⁴ *Syst. Algarum*, p. 233.⁵ *The Ceylon Moss*, Lond. 1840.⁶ *Fuci*, vol. ii. p. 124.⁷ *History of the Indian Archipelago*, vol. iii. p. 446, 1820.

most cylindrical and filiform; but, when examined by a microscope, they appear shrivelled and wrinkled. The branchings are sometimes dichotomous, at other times irregular. Dr. Farre states that in a bale opened at Mr. Battley's, about $\frac{1}{15}$ th appeared to bear fructification. The tubercles (*coccidia*) are inconspicuous when dry, but when moist, are readily seen. They are hemispherical, about the size of a poppy-seed, and contain, according to Rumphius, a mass of minute, oblong, dark red spores. The consistence of Ceylon moss is cartilaginous. Its flavour is that of sea-weed, with a feebly saline taste.

COMPOSITION.—This algal has been examined chemically, in 1834, by Dr. O'Shaughnessy;¹ in 1842, by Guibourt;² and in 1843, by Wonneberg and Kreyssig,³ by Bley,⁴ and by Riegel.⁵

O'Shaughnessy's Analysis.	
Vegetable jelly	54.50
True starch	15
Ligneous fibre	18
Gum	4
Wax	a trace
Sulphate and muriate of soda	6.50
Sulphate and phosphate of lime	1
Iron	a trace
	99
Assume the traces of the wax and iron, and the loss, at	1
Total	100

Bley's Analysis.	
Pectin	37.5
Lichen	3.85
Ligneous fibre	16.08
Gum	1.2
Albumen	0.9
Fatty matters	19.95
Lichenic acid	0.05
Chloride of calcium	0.20
Chloride of sodium	1.72
Water	18.5
	99.95
The ashes of the ligneous fibre contained chloride of sodium, sulphates of lime and of magnesia, carbonates of lime and magnesia, oxide of iron, silica, and iodic salt.	

Riegel's Analysis.	
Soluble gelatine	78.5
Starch	6.0
Starchy skeleton	12.1
Resin	0.63
Chloride of sodium	1.85
Chloride of magnesium	0.54
Sulphate of soda	0.38
	100.00
The ashes of the skeleton contained sulphate of lime, phosphate of lime, and magnesia.	

1. MUCILAGINOUS MATTER (*Carrageenin?*); *Vegetable Jelly*; *Pectin*; *Soluble gelatine*.—The mucilaginous or gelatinizing principle of Ceylon moss appears to me to agree very closely, if indeed it be not identical, with carrageenin. It has not hitherto been analyzed.

2. STARCHY MATTER.—This resides chiefly in the cortical portion of the algal. But the internal cell-walls become deeply stained purplish brown on the addition of iodine, as if they were composed of a starchy substance (*starchy skeleton*).

CHEMICAL CHARACTERISTICS.—By moistening Ceylon moss with a weak solution of ioduretted iodide of potassium, the plant acquires a purplish-brown or red colour; the younger and more delicate fibres becoming almost black. The change of colour is most intense in the cortical portion, but the internal cell-walls also become stained. By digestion in warm water, the plant softens and swells up. By boiling it in water, and then compressing and rubbing it gently between two plates of glass, the larger spheroidal cells are readily separated from each other: they are stained purplish-brown by iodine. The aqueous decoction is mucilaginous, and when sufficiently concentrated, gelatinizes on cooling. Iodine colours it a dull or purplish brown, and gives an intense dark purplish colour to the undissolved residue of the plant. If the plant be immersed in diluted hydrochloric acid, slight effervescence occurs, owing to the escape of carbonic acid evolved by the action of the hydrochloric acid on carbonate of lime.

PHYSIOLOGICAL EFFECTS.—These are similar to those of *Chondrus crispus* (see *ante*, p. 59). Ceylon moss, therefore, may be denominated nutritive (chiefly as an element of respiration, see vol. i. p. 116), emollient, and demulcent. By the continued use of it at the table, the saline constituents of the plant would not be without some influence on the system.

USES.—In the form of decoction or jelly, it is employed as a light and readily digestible article of food for invalids and children. The residue of the decoction is not devoid of nutritive matter, and might be served and eaten like cabbage or leguminous substances; especially when the alterative influence of the saline constituents is desired. The decoction or jelly of Ceylon moss may be employed in irritation of

¹ Sigmond and Farre, *The Ceylon Moss*, p. 74, 1840.

² *Journ. de Chimie Méd.* t. viii. 2nde sér. p. 368, 1842.

³ *Pharmaceutisches Central Blatt für* 1843, p. 252.

⁴ *Ibidem*, p. 409.

⁵ *Ibidem*.

the mucous surfaces, and in phthisis. It is not apt to occasion thirst, sickness, flatulence, heartburn, acidity, or diarrhœa.

ADMINISTRATION.—It may be administered in the form of decoction or jelly. Dr. O'Shaughnessy recommends that it should be steeped for a few hours in cold rain water, as the first step to its preparation: this removes a large portion of the sulphate of soda. It should then be dried by the sun's rays, and ground to a fine powder; for cutting or pounding, however diligently performed, still leaves the amylaceous matter so mechanically protected that the boiling may be prolonged for hours without extracting the starch. This grinding process, however, is seldom employed, the prepared plant being merely cut into very small pieces.

1. DECOCTUM PLOCARIÆ CANDIDÆ; *Decoction of Ceylon Moss.*—This is prepared by boiling the prepared moss in water, milk, or whey. One drachm of the plant will give a mucilaginous quality to eight ounces of water. Milk, sugar, orange or lemon juice and peel, wine, cinnamon, or other aromatics, may be used to communicate flavour. This decoction may be taken *ad libitum*.

2. GELATINA PLOCARIÆ CANDIDÆ; *Jelly of Ceylon Moss.*—Mr. Previté's directions for its preparation are the following: Boil half an ounce of the prepared moss in a quart of boiling water for twenty-five minutes, or until a spoonful of the liquid forms into a firm jelly within two or three minutes after it is removed from the boiler. Flavour with wine, a little cinnamon, lemon or orange juice and peel, and sweeten according to taste. Boil the whole for five minutes, and pass it two or three times through a jelly-bag or doubled muslin. Leave it undisturbed, and it will become a firm jelly in ten minutes. If it be required perfectly clear for table use, add the white of two eggs beaten up into a whip before the second boiling, and allow it to stand for a few minutes away from the fire, with some hot coals on the top of the boiler. When clear, pass it through the jelly-bag, and leave it to congeal. Should the jelly be required particularly firm, add an ounce of moss to the quart of water.

6. PLOCARIA HELMINTHOCORTON, *Endl.*—CORSICAN MOSS.

Sex. Syst. Cryptogamia Algæ.
(*Planta, Offic.*)

HISTORY.—This plant has been in use for several centuries among the natives of Corsica, as a remedy for intestinal worms. In 1756, Vaucher sent it to Paris.¹

BOTANY.—Gen. Char.—See *Plocaria candida*, p. 60.

Sp. Char.—*Frond* cartilaginous, terete, tufted, entangled. *Stem* filiform, creeping; branches setaceous, somewhat dichotomous, marked indistinctly with transverse streaks.

Hab.—The Mediterranean Sea, on the shores of Corsica.

PHYSICAL PROPERTIES.—Under the name of Corsican moss, is sold in the shops a mixture of various marine vegetables and animals. The essential, though usually smaller, part of the mixture is the *Plocaria Helminthocorton*; the remainder consists of *Corallines*, *Sertularias*, and *Ceramiums*, to the number of twenty species.² Lamouroux states he found the remains of eighty species of marine plants.³ (See also T. C. Martius.)⁴

The structure of the frond of *Plocaria Helminthocorton* is "very peculiar, being exceedingly lax and cellular, with a consistence similar to that of the stems and leaf-stalks of some aquatic herbaceous phænogamous plants, and having the appearance of articulations which do not actually exist."⁵ The fructification is scarcely

¹ J. P. Schwendimann, in Schlegel's *Thesaurus Mat. Med.* t. iii. p. 181.

² De Candolle, *Essai sur les Propriétés Méd.* p. 348, 2d ed.

³ Fée, *Cours d'Hist. Nat.* i. 147.

⁴ Greville, *Algæ Brit.* p. 146.

⁵ *Grundriss d. Pharmakog.* 12.

ever seen. The plant has a reddish-gray colour externally, but is whitish internally. Its odour strong, marine, and disagreeable: its taste is saline.

COMPOSITION.—Bouvier¹ obtained from 100 parts of Corsican moss, *vegetable jelly* [mucilage? carrageenin?] 60.2; *vegetable fibre*, 11.0; *chloride of sodium*, 9.2; *sulphate of lime*, 11.2; *carbonate of lime*, 7.5; *iron*, *manganese*, *silica*, and *phosphate of lime*, 1.7. Straub² and Gaultier de Claubry³ have subsequently detected iodine, but the quantity is small.

CHEMICAL CHARACTERISTICS.—Corsican moss effervesces with acids, owing to the carbonate of lime which it contains. The brown watery infusion is deepened in colour by sesquichloride of iron, and lets fall some brown flocculi. Tincture of galls does not alter it. Nitric acid and starch give no indication of iodine.

PHYSIOLOGICAL EFFECTS.—Its effects are not very obvious. The vegetable jelly (mucilage) must render it somewhat nutritive; the iodine and saline matters alterative. Mr. Farr⁴ says that, after using the decoction for six or seven days, it acts as a diuretic and diaphoretic, and occasionally produces nausea and giddiness: after some time the stools become darker, present greenish specks, and are sometimes slimy.

USES.—It has been principally celebrated as an anthelmintic against the large round worm (*Ascaris lumbricoides*). Bremser⁵ ascribes its efficacy to chloride of sodium.

In 1822, Mr. Farr brought it forward as a remedy for cancer. He was led to try it from the circumstance of Napoleon Bonaparte having stated to Barry O'Meara that it was used in Corsica for dispersing tumours. Experience does not warrant us in ascribing any benefit to its employment in this disease.

ADMINISTRATION.—In *powder*, it is given in doses of a scruple to two drachms, mixed with honey or sugar; but the more usual mode of exhibiting it is in the form of *decoction*, prepared by boiling from four to six drachms of it in a pint of water; of this the dose is a wineglassful three times daily.

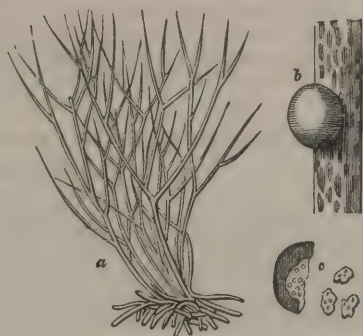
ORDER II. LICHENES, *Juss.*—LICHENS.

LICHENALES, *Lind.*

CHARACTERS.—Perennial, aerial thallogens, nourished through their whole surface by the medium in which they vegetate; always constituting a *thallus*, *crust*, or *frond* (*receptaculum universale*; *blastema*) formed of a cortical and a medullary layer, of which the former is simply cellular, the latter cellular and filamentous. *Apothecia* (*fructus*) consisting of a *receptacle* and a *proliferous layer* (*lamina prolifera*) composed of *spores* (*sporæ*) naked or enclosed in *spore-cases* (*asci*; *thecæ*), united to form a *nucleus* or disposed on a *disk* (*discus*).

PROPERTIES.—The tissue of lichens consists of *cellulose*. Many of them contain *amylaceous matters* (*lichenin* or *feculoid*, and *inulin*) and their congeners *gum* and *sugar*, which render them nutritive, emollient, and demulcent. *Bitter principles* (*cetraric acid*; *picrolichenin*) are sometimes found in lichens: these confer slight tonic properties. *Colouring matters* (*thallochlor*, *chrysophanic acid*, &c.) are frequently present. *Colorific principles* (*orcellic*, *erythric*, *lecanoric*, and other *acids*), or principles which, under the combined influence of ammonia and oxygen, form colouring

Fig. 160.



Plocaria Helminthocorton.

- a. The plant (natural size).
- b. A small stony coral attached to the thallus, and which may be readily mistaken for the fructification.
- c. The same, broken and magnified to show the pores.

¹ *Ann. de Chim.* ix. 83, 1791.

² *Gilbert's Ann.* Bd. lxxi. S. 242.

³ *Ann. de Chim.* xciii. 134.

⁴ *A Treatise explanatory of a Method whereby occult Cancers may be cured*, 2d ed. 1825.

⁵ *Sur les Vers Intestin.* 414.

matters (*orceine*, &c.), render some of the lichens valuable in the arts. Besides the before-mentioned bodies, several other *vegetable acids* (as the *tarturic*, *oxalic*, *tannic*, and *lichestearic*) are found in the lichens. The oxalic acid is found in combination with lime: one lichen (*Varicaria faginea*) contains 47 per cent. of calcareous oxalate. The *ashes* of the lichens constitute about 8 per cent. of the dried plants, and consist principally of the earths: the ashes of lichens growing on siliceous rocks contain more silica than those of lichens growing in other situations. It is deserving of especial notice that not a single poisonous lichen is known.

The lichens which I shall have to notice may be conveniently divided, according to their uses, into the esculent, the medicinal, and the tinctorial lichens.

1. LICHENES ESCULENTI ET MEDICINALES.—EDIBLE AND MEDICINAL LICHENS.

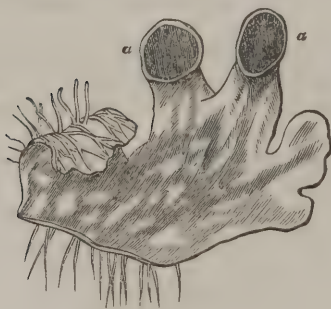
The only lichen employed medicinally by British practitioners is Iceland moss (*Cetraria islandica*). But several other lichens, whose medicinal qualities are in reality similar to, though much feebler than, Iceland moss are still kept in the London herb-shops, being occasionally employed as popular remedies. Those which I have met with are *Peltidea canina*, *Scyphophorus pyxidatus*, and *Sticta pulmonaria*. These, as well as *Gyrophora*, *Parmelia parietina*, and *Cladonia rangiferina*, require a short notice.

7. *Peltidea canina*, Ach.—Ash-coloured Ground Liverwort.

PELTIDEA CANINA, Ach. Syn. p. 239; *Lichen caninus*, Linn.; *Lichen cinereus terrestris*, Woodville, Med. Bot. vol. iv; *Ash-coloured ground liverwort*.

This species, and also *Peltidea rufescens*, Ach., are sold in the herb-shops as *Ground Liverwort*. It formerly was in repute as a preservative against the bite of a mad-dog,¹ and, mixed with half its weight of black pepper, it formed the *pulvis antilyssus* (ἀντί, against, and λύσσα, canine madness) of the London Pharmacopœia for 1721.

Fig. 161.



Peltidea canina.

Portion of the thallus, with the apothecia, a, a. (Natural size.)

Fig. 162.



Scyphophorus pyxidatus.

a. The poedium. b. The cup or scypha. c c. The apothecia.

8. *Scyphophorus pyxidatus*, Hook.—Cup-Moss.

SCYPHOPHORUS PYXIDATUS, Hook, Engl. Fl. vi. p. 238; *Cenomyce pyxidata*, Ach. Syn.; *Cladonia pyxidata*, Schær. Lich. Helv. Spicil. p. 26; *Lichen Pyxidatus*, Linn.; *Muscus pyxidatus*, Dale, Pharm.; *Cup-moss*.—This species (frequently mixed with *S. fimbriatus*, Hook., and sometimes with *S. cocciferus*, Hook.) is the Cup-moss of the shops. It was recommended by Dr. Willis² as a remedy for hooping-cough.³ He gave it in drachm doses, in the form of powder, decoction, and syrup.

¹ *Phil. Trans.* vol. xx. p. 49; Mead, *A Mechan. Account of Poisons*, 5th ed. p. 165, Lond. 1756.

² *Pharmaceutice Rationalis*, pars 2da, p. 49, 1678.

³ See, also, Dillenii, *Dissertatio de Lichene Pyxidato*, in Schlegel's *Thesaurus Materia Medicæ*, t. i. p. 307, Lipsiæ, 1793.

9. *Sticta pulmonaria*, Hook. — Tree Lungwort.

STICTA PULMONARIA, Hook, Engl. Fl.; *St. pulmonacea*, Ach. Syn. p. 233; *Lichen pulmonarius*, Linn.; *Muscus pulmonaria*, Dale, Pharm.; *Tree Lungwort*, *Oak-Lungs*.—This lichen has been analyzed by John,¹ who found it to contain resinous chlorophylle, 2; bitter extractive, 8; lichen starch, 7; insoluble matters, 80; salts, &c. 3. Its virtues are dependent on the bitter and amy-laceous matter, and are similar, but inferior, to those of Iceland moss. It has been esteemed as a pectoral in pulmonary affections; as an astringent in internal hemorrhages, and as a remedy for jaundice. It has been given in doses of a drachm, in the form of powder or decoction. In Siberia, where the plant seems to be more bitter than in this country, it is employed as a substitute for hops in brewing.²

10. *Gyrophora*.

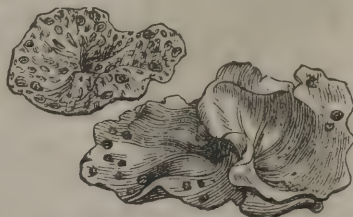
Several species of *GYROPHORA* (as *G. proboscidea* β *arctica*, *G. hyperborea*, *G. Pennsylvanica*, and *G. Muhlenbergii*) are employed by the hunters of the Arctic regions of America as articles of food, under the name of *tripe de roche*. All four species were eaten by Captain Franklin and his companions in 1821, when suffering great privations in America; and to its use may their preservation be in part ascribed.³ But, not having the means of extracting the bitter principle, these lichens proved noxious to several of the party, producing severe bowel complaints.

Fig. 163.

*Sticta pulmonaria*.

Portion of the thallus with the apothecia (scutellæ).
a. Cyphellæ. b. Section of the apothecium.

Fig. 164.

*Tripe de Roche*.
(*Gyrophora*.)11. *Cladonia rangiferina*, Hoffm. — Rein-Deer Moss.

CLADONIA RANGIFERINA, Hoffm.; *Cenomyce rangiferina*, Ach. Syn. p. 277; *Lichen rangiferinus*, Linn.; *Rein-deer Moss*.—This lichen has become celebrated on account of the beautiful description of it, and of its uses, given by Linnæus, in his *Flora Lapponica*, p. 332. It is this plant which, for the greatest part of the year, and especially during the winter season, is the support of the vast herds of rein-deer, wherein consists all the wealth of the Laplanders.

I have frequently bought this lichen, along with others, of the London herbalists, who, however, are unacquainted with its real name; but who sell various species of lichens, under the denomination of "mosses," for the use of bird stuffers, who decorate the inside of their cases with them.

Fig. 165.

*Cladonia rangiferina*.¹ Gmelin, *Handb. d. th. Chem.* Bd. ii. S. 1351, 1829.² Murray, *App. Medicam.* vol. v. p. 520.³ Franklin, *Narrative of a Journey to the Shores of the Polar Sea*, 1823.

12. CETRARIA ISLANDICA, Ach.—ICELAND MOSS.

Sex. Syst. Cryptogamia, Algæ.

(Planta, Offic.)

HISTORY.—The medicinal properties of this plant (usually termed *Lichen islandicus*) were probably first known to the natives of Iceland. According to Borrichius, the Danish apothecaries were acquainted with them in 1673. In 1683, Hjärne spoke favourably of its effects in hæmoptysis and phthisis.

BOTANY. Gen. Char.—*Thallus* foliaceous, cartilagino-membranaceous, ascending and spreading, lobed and laciniated, on each side smooth and naked. *Apothecia* orbicular, obliquely adnate with the margin of the thallus, the lower portion being free (not united with the thallus); the disk coloured, plano-concave, with a border formed of the thallus and inflexed (*Hooker*).

Sp. Char.—*Thallus* erect, tufted, olive brown, paler on one side, laciniated, channelled, and denticulate, the fertile lacinia very broad. *Apothecia* brown, appressed, flat, with an elevated border (*Hooker*).

Hab.—Dry mountainous districts of the new and old continents. Although met with in considerable abundance in Scotland, it is never gathered there as an article of commerce.

The word *cetraria* is derived from *cetra* or *caetra* (χαίτρα, Hesyeh), an ancient shield made of leather, which the apothecia are supposed to resemble.

COLLECTION.—The lichen should be collected on dry and clear days, carefully deprived of all foreign matter by hand-picking, and dried in the sun.

PHYSICAL PROPERTIES.—The Iceland moss of commerce (*muscus islandicus*; *lichen islandicus*) is in general brownish or grayish white; the upper surface darker, towards the base sometimes marked with blood-red spots; the under surface paler, whitish, with white spots which have a chalky or mealy appearance, are lodged in little depressions of the thallus, and when submitted to microscopic examination appear warty, pearl-white masses. Apothecia are rather rare on the commercial lichen. When quite dry, the lichen is crisp, cartilaginous, and coriaceous. It is almost odourless, and has a bitter mucilaginous taste. Its powder (*farina*) is whitish gray.

COMMERCE.—It is imported in barrels and bags from Hamburgh and Gottenburgh, and is said to be the produce of Norway and Iceland. In 1836, 20,599 lbs. paid duty; in 1837, 12,845 lbs.; in 1838, 6179 lbs.; in 1839, 15,933 lbs.; and in 1840, 6462 lbs.

COMPOSITION.—It was analyzed by Berzelius¹ in 1808, who obtained the following products from 100 parts:—green wax, 1.6; yellow extractive matter, 7.0; bitter matter, 3.0; uncrystallizable sugar, 3.6; gum, 3.7; starch, 44.6; starchy skeleton, 36.2; gallic acid, trace; bitartrate of potash, tartrate of lime, and a little phosphate of lime, 1.9 (=101.6). In 1844–5 it was examined by Messrs. Schnedermann and Knop.²

The following figures represent the microscopic appearances of sections of the lichens.

Fig. 166.

*Cetraria islandica.*

a. The apothecia on the larger lobes of the thallus.

¹ Ann. de Chim. xc. 277.

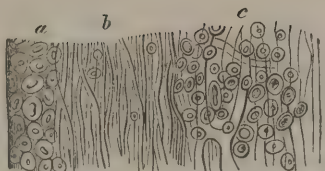
² Annal. der Chim. u. Pharm. Bd. lv. S. 144, 1845; Pharm. Journ. vol. v. p. 427, 1846.

Fig. 167.



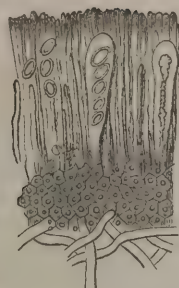
Transverse section of the thallus.

Fig. 168.



Longitudinal section of the thallus.

Fig. 169.



Longitudinal section of the apothecium, with the thecae and the adherent filamentous layer.

Sections of Cetraria Islandica (highly magnified).

- a. External or cortical layer, which does not become blue by the addition of the tincture of iodine.
- b. Subcortical layer (*stratum gonimicum*), Wallroth; *stratum faculare*, Wahlenberg), which becomes blue on the addition of tincture of iodine.
- c. Medullary layer, composed of felted filaments or tubes (*tela contexta*, Schleiden), and intermixed nucleated cells (*annuli*, Link).

1. **AMYLACEOUS MATTER**—*Cetraria islandica* contains at least two kinds of amylaceous matter, namely, one which is coloured blue by iodine (*lichen-starch*), and one which does not become blue with this agent (*inuline*).

Link¹ states that the amylaceous matter of *Cetraria* does not occur in a globular form. If by amylaceous matter is to be understood starch grains, which are rendered blue by iodine, my observations confirm his statement. Payen,² however, says he has seen the starch of Iceland moss in the form of little balls; but he has probably mistaken the cells for starch grains. When a thin section of the thallus has been soaked in cold water and then placed under the microscope, a general blue tint is communicated to the subcortical layer (see Figs. 167 and 168), on the addition of tincture of iodine: but none of the cells or granules become blue. A starchy non-granular matter, rendered blue by iodine, appears to reside in the intercellular tissue of the subcortical layer. My friend Mr. Henry Deane has traced this amylaceous matter to the surface of the apothecia, which appears to be deficient in the cortical non amylaceous layer. Moreover, iodine colours sections of the apothecia in stripes; rendering blue the starchy matter between the thecae and elongated cells (see Fig. 169).

I have sometimes seen the nucleated cells of the medullary layer (see Fig. 168) assume an amber colour when treated with iodine. Is this owing to the presence of inuline?

a. *Lichen-starch*. This becomes blue on the addition of iodine. According to Schnedermann and Knopp, hydrochloric acid converts it into a transparent jelly. Its formula, according to Mulder, is $C^{12}H^{10}O^{10}$.

Even after very prolonged boiling in water the tissue of Iceland moss still retains the property of being tinged blue by iodine: hence it has been called *amylaceous tissue*, *starchy skeleton*, &c. Mulder says, that when boiled sufficiently and acted on by solvents, the final residue of it is nothing but *cellulose*: it is improper, therefore, to call it amylaceous tissue.

β . *Inuline*. This, according to Payen and others, is a constituent of Iceland moss. It is tinged yellow by iodine. When insoluble in cold water its formula is probably $C^{12}H^{10}O^{10}$.

Mulder is of opinion that the chief part of lichen-starch must be composed of a starch which like inuline is turned yellow by iodine, and like common starch can be precipitated by basic acetate of lead.

2. **CETRARIC ACID**; *Cetrarin*; *bitter principle of Iceland moss*—This resides in the cortical portion of the thallus. It exists there for the most part in the state of free cetraric acid, and not as a cetrarate. In the pure state the acid occurs in the form of shining minute acicular crystals. It is intensely bitter, not volatile, and is infusible without decomposition. It is almost insoluble in water, which, however, acquires a bitter taste when boiled with the acid. It is

¹ *Icones selectæ Anatomico-Botanica*, Fascic. iii. Berlin, 1841.

² *L'Institut de 1837*, p. 145.

soluble in boiling alcohol, but crystallizes in great part on cooling. It is slightly soluble in ether, and is quite insoluble in the fixed and volatile oils. Its formula is $C^{34}H^{16}O^{15}$. It is dissolved both by the caustic and carbonated alkalies, and is precipitated from its solution by acids. *Cetraric acid* (2NH³, C³⁴H¹⁶O¹⁵) is a beautiful yellow salt, having a faint ammoniacal odour, and being soluble in water. By exposure to the air it gradually becomes brown. Schnedermann explains the production of the brown colour of Iceland moss by supposing that the cetraric acid of the thallus absorbs atmospheric ammonia, and the cetraric acid thus formed becomes brown by exposure to the air. The alkaline cetrarates yield a red colour (*cetraric acid of iron*) with the salts of the peroxide of iron. Now as the ashes of Iceland moss contain iron, Schnedermann thinks it not improbable that the red spots which are sometimes found at the base of the lichen may be due to the presence of cetraric acid of iron, produced by the action of cetraric acid of ammonia (formed as above explained) on the ferruginous constituent. *Cetraric acid of lead* (2PbO, C³⁴H¹⁶O¹⁵) forms a yellow flocculent precipitate.

3. **LICHESTEARIC ACID** (so called from *λεῖχην*, lichen; and *στέαρ*, fat). When pure it is perfectly white, and consists of pearly crystalline plates. It is odourless, but has an acrid taste. It is soluble in alcohol, ether, and the volatile and fatty oils, but is insoluble in water. At 248° F. it melts, and on cooling congeals into a crystalline mass. It cannot be volatilized without decomposition. Its formula is C²⁹H²⁵O⁶. It is dissolved by alkalies, and is precipitated from its alkaline solution by acids. *Lichestearate of potash* is a white indistinctly crystalline powder: *Lichestearate of silver* (AgO, C²⁹H²⁴O⁵) is grayish white: *Lichestearate of lead* (PbO, C²⁹H²⁴O⁵) is white: *Lichestearate of baryta* is grayish white: *Lichestearate of ammonia* is crystallizable.

4. **FUMARIC ACID; Lichenic acid.**—This acid was discovered in Iceland moss by Pfaff.

5. A neutral substance, called provisionally "*the body C*," is mentioned by Schnedermann as being contained in tolerable quantity in the lichen. It is white, tasteless, insoluble in water, ether, oils, alkalies, and acids, and difficultly soluble in hot spirit.

CHLOROTHALLE; Thallochlor.—This is the green colouring matter. It is soluble in ether, alcohol, and petroleum. It has the properties of a weak acid, and is distinguished from chlorophyll by being little or not at all soluble in hydrochloric acid.

CHEMICAL CHARACTERISTICS.—Iceland moss swells up in cold water, to which it communicates some portion of bitterness, and a very little mucilage. If to the moistened thallus some tincture of iodine be added, the tissues become intensely blackish blue; but the white chalky or mealy-looking spots, before mentioned, are unaltered by iodine, and appear more brilliantly white, in consequence of the black ground on which they are placed.

By prolonged boiling in water, the lichen yields a mucilaginous decoction, which, when sufficiently concentrated, gelatinizes on cooling. A solution of iodine communicates a blue colour (*iodide of starch*) to the cold decoction.

When the decoction has been imperfectly prepared in consequence of being weak, and insufficiently boiled, it yields a dingy green colour with iodine. The green colour depends on the mixture of two coloured substances: one yellow, the other blue. "If," says Mulder, "a diluted decoction of Iceland moss, after being coloured with iodine, is allowed to settle for a while, the layer at the bottom is yellow, and that immediately above is blue."

The decoction yields, with the basic acetate of lead, a copious whitish precipitate (*amylate of lead*); and with a mixture of sulphate of copper and potash, a green precipitate (*cetraric acid of copper*).¹

The sesquisalts of iron communicate a red colour (*cetraric acid of iron*), both to the decoction and to an alcoholic tincture of Iceland moss (prepared by digesting 3ij of the lichen in f3vj of rectified spirit).

In strong hydrochloric acid the thallus swells up, owing to the gelatinization of the starch contained in the intercellular spaces.

PHYSIOLOGICAL EFFECTS. α. *On animals.*—In Carniola, pigs, horses, and oxen are fattened by it.²

β. *On Man.*—It is a mucilaginous or demulcent tonic, without any trace of astringency. If the bitter matter (*cetraric acid*) and extractive be removed, it is nutritive, emollient, and demulcent, like ordinary starch, over which it has no advantage. Captain Sir John Franklin and his companions tried it as an article of food, when suffering great privations in America, but its bitterness rendered it hardly eatable.³

¹ Herberger, *Journ. de Pharm.* xxii.

² *Narrative of a Journey to the Shores of the Polar Sea*, p. 414, 1823.

³ Murray, *App. Med.* v. 506.

USES.—Iceland moss is well adapted to those cases requiring a nutritious and easily-digested aliment, and a mild tonic not liable to disorder the stomach. It has been principally recommended in chronic affections of the pulmonary and digestive organs, particularly phthisis, chronic catarrh, dyspepsia, chronic diarrhoea, and dysentery; but its efficacy has been much exaggerated.

ADMINISTRATION.—It is best exhibited in the form of decoction. When employed as an alimentary substance merely, the bitter matter should be extracted before ebullition. This is effected by digesting the lichen in a cold weak alkaline solution (composed of water 300 parts, and carbonate of potash 1 part), and afterwards washing it with cold water.¹ But the subsequent washing will not remove the whole of the alkaline salt. Instead, therefore, of using an alkali, distilled water may be used to extract the bitter principle. The lichen should be heated once or twice in water up to about 180° F., by which the lichen will be deprived of most of its bitterness. It is then to be boiled in water or milk. When the decoction is sufficiently concentrated it gelatinizes on cooling. It may be flavoured with sugar, lemon peel, white wine, or aromatics, and then forms a very agreeable kind of diet.

DECOCTUM CETRARIAE, L. [U. S.]; *Decoction Lichenis Islandici*, D.; *Decoction of Iceland Moss*. (Iceland Moss $\mathfrak{z}\text{v}$ [$\mathfrak{z}\text{j}$, D. ($\mathfrak{z}\text{ss}$, U. S.)]; Distilled Water [Water, U. S.] Ojss; boil down to a pint, and strain.) Dose, $\text{f}\mathfrak{z}\text{j}$ to $\text{f}\mathfrak{z}\text{iv}$ every four hours.

13. *Parmelia parietina*, Ach.—Common Yellow Wall Lichen.

PARMELIA PARIETINA, Ach.; *Lobaria parietina*, Hoffm.; *Lichen parietinus*, Linn.; *Common Yellow Wall Lichen*. Usually sold in the herb shops under the name of *common yellow wall moss*. $\chi\rho\iota\varsigma\ \phi\acute{\upsilon}\lambda\lambda\omicron\nu$, hodie in Zacyntho, Sibth. Thallus foliaceous, membranaceous, orbicular, bright-yellow: the lobes marginal, radiating, rounded, crenate, and crisped, granulated in the centre, beneath paler and fibrillose. Apothecia deep-orange, concave with an entire border (*Hooker*). This lichen has been the subject of repeated chemical investigation. According to Herberger,² it contains two beautiful colouring matters (parmelia-yellow and parmelia-red), several alimentary principles (gliadin, sugar, starch, and gum), and three medicinal substances (soft resin, bitter matter, and volatile oil); besides wax, stearine, chlorophylle, and woody fibre. Roehleder and Heldt³ give the name of *chrysophanic acid* ($\text{C}^{10}\text{H}^8\text{O}^3$) to the golden yellow crystallizable colouring matter, which, more recently, Schlossberger and Doepping⁴ have found to be identical with the yellow colouring matter of rhubarb (*rheine, rheumine, rhubarbaric acid*). In 1815, this lichen was lauded by Dr. Sander⁵ as a valuable substitute for cinchona bark in intermittents. He also gave it with success in hemorrhages and fluxes. Haller had previously spoken favourably of it as a tonic in diarrhoea and dysentery; and Willemet had found it useful in contagious autumnal fluxes. Subsequent experience, however, has not confirmed the favourable reports made of its medicinal power. The dose of it in powder is from $\mathfrak{H}\text{j}$ to $\mathfrak{z}\text{j}$. It may also be given in the form of decoction, tincture, and extract. Dr. R. D. Thomson⁶ has proposed it as a test for alkalies, which communicate to its yellow colouring matter (called by him *parietin*) a beautiful red tint.

2. LICHENES TINCTORII.—TINCTORIAL LICHENS.

1. NUMBER AND VARIETY.—A considerable number of lichens have been employed by man on account of the colouring matter which they yield him. Some of them (e. g., *Parmelia parietina* and *Evernia vulpina*) contain colouring principles (e. g., *chrysophanic* and *vulpinic acids*). Others (e. g., several species of *Rocella*, of *Lecanora*, of *Variolaria*, &c.) contain principles (e. g., *orsellie*, *erythric*, *lecanoric*, and *gyrophoric acids*) which are colourless while in the plant, but

¹ Dr. Davidson, in a paper *On the Removal of the bitter taste and lichenous odour of Iceland Moss* (Jameson's *Edinb. New Phil. Journ.* vol. xxviii. p. 260, 1840), recommends a solution of caustic potash for extracting the bitter taste of this lichen. A pound of carbonate of potash (rendered caustic by a pound of lime) is sufficient for 28 lbs. of the plant.

² Buchner's *Repertorium*, Bd. xlvii. S. 179, 1834.

³ *Ann. d. Chem. u. Pharm.* Bd. xlviii. S. 12, 1843; and *Chem. Gazette*, vol. ii. p. 162, 1844.

⁴ *Ann. d. Chem. u. Pharm.* Bd. i. S. 295, 1814; *Pharm. Journal*, vol. iv.

⁵ *Die Wandflechte, ein Arzneimittel, welches die peruv. Rinde nicht nur entbehrlich macht, sondern die auch an gleichart. Heilkräften übertrifft*, 4to. Sondershausen, 1815.

⁶ *Lond. Ed. and Dub. Phil. Mag.* July, 1844.

which, under the influence of alkalies and atmospheric oxygen, yield colouring matters (e. g., *orceine*). Such principles I shall distinguish as *colorific*, or colour-making.

2. **COLOURS.**—Lichens furnish four principal colours, viz., brown, yellow, purple, and blue.

a. **Brown** colours are yielded by *Gyrophora pustulata* and *Sticta pulmonaria* (see *ante*, p. 65). The former lichen, says Professor Guibourt,¹ produces on silk, by using, as mordants, bitartrate of potash and chloride of tin, a very fine and durable carmelite colour. For use in France, it is principally collected in the Vosges.

β. **Yellow** colours are yielded by *Parmelia parietina* (see *ante*, p. 69) and *Evernia vulpina*. The former lichen contains, as its yellow colouring principle *chrysophanic acid*; the latter, according to M. Bébert,² contains a yellow crystallizable acid called *vulpinic acid*.

γ and *δ.* **Purple and blue** colours are yielded by a considerable number of lichens. In this country, purple colours (*orchil* and *cudbear*) only are obtained from them; but in Holland a blue colour (*litmus*) is also prepared from these. And it appears that the same lichens yield either the one or the other colour according to the method of treatment.

The orchil makers of this country call the cylindrical and flat species of *Roccella* used in the manufacture of orchil and cudbear, *weeds* or *orchella weeds*, and distinguish them according to the countries yielding them (e. g., *Angola weed*, *Canary weed*, &c.); while the crustaceous and foliaceous lichens, employed for similar purposes, they term *mosses* (e. g., *tartareous moss*, *pustulatus moss*, *rock moss*, &c.). A similar distinction is made in French commerce; the term *herbe* being applied to what the English call a *weed*, while the name of *lichen* is given to what our dealers term a *moss*.

The following is a list of the principal lichens employed by British manufacturers of orchil and cudbear, with their commercial names:—

Orchella Weeds.

Angola Orchella weed	(<i>R. fuciformis</i>).
Madagascar "	(<i>R. fuciformis</i>).
Mauritius "	"
Canary "	(<i>R. tinctoria</i>).
Cape de Verd "	(<i>R. tinctoria</i>).
Azores "	(<i>R. tinctoria</i>).
Madeira "	(<i>R. tinctoria</i> and <i>R. fuciformis</i>).
South American (Lima), large and round	"
" " " small and flat	(<i>R. tinctoria</i> ?)
" " " " "	(<i>R. fuciformis</i>).
Cape of Good Hope	(<i>R. hypomecha</i>).
Barsby (Mogadore)	(<i>R. tinctoria</i>).
Corsican and Sardinian	(<i>R. tinctoria</i>).

Mosses.

Tartareous moss	(<i>Lecanora tartarea</i>).
Pustulatus moss	(<i>Gyrophora pustulata</i>).
Canary Rock moss	(<i>Parmelia perlata</i> ?) ³
Corsica and Sardinia Rock moss.	
Norway Rock moss.	

Mr. Harman Visger, of Bristol, informs me that "every lichen but the best orchella weed is gone or going rapidly out of use; not from deterioration of their quality, for, being allowed to grow, they are finer than ever; but because the Angola-weed is so superior in quality, and so low-priced and abundant, that the product of a very few other lichens would pay the expense of manufacture."

In France, the *Variolaria dealbata*, De Cand., and *V. orcina* or *orcina*, Ach. (the *Pareille d'Auvergne*) are employed in the production of orchil. These two lichens constitute the *V. corollina*, Ach., which must be confounded neither with *Lecanora parella*, Ach., nor with *Isidium corallinum*, Ach.

3. **COLORIFIC PRINCIPLES.**—These in most, if not in all, cases are organic acids: e. g., *alpha orsellic*, *beta orsellic*, *erythric*, *lecanoric*, *gyrophoric*, *evernic*, *usnic*, &c. acids.

Under the united influence of water, atmospheric oxygen, and ammonia, these colorific principles yield coloured products, which, though probably not identical, pass under the general name of *orceine*.

The precise chemical changes which these colorific principles undergo when exposed to the joint action of water, air, and ammonia, are not definitely known. Some of these principles are not directly converted into coloured substances, but into intermediate colourless substances. Thus *lecanoric acid* becomes first *orcine* and then *orceine*. Liebig, adopting the formulæ which have been given for these three bodies respectively by Schunck, Will, and Dumas, has given the following explanation of the changes: Lecanoric acid, $C^{16}H^8O^8$, gives out two atoms of carbonic acid, C^2O^4 , and becomes anhydrous orcine, $C^{16}H^8O^4$, which, with three atoms of water, H^3O^3 , yields one atom of crystallized orcine, $C^{16}H^{11}O^7$; and one atom of crystallized orcine, $C^{16}H^{11}O^7$, with one atom of ammonia, NH^3 , and five atoms of oxygen, yield one atom of orceine, $C^{16}H^9NO^7$, and five atoms of water: but the accuracy of the formulæ has been called in question.

¹ *Hist. Nat. des Drog. simpl.* t. 2me p. 77, 4me éd. 1849.

² *Journ. de Pharm.* t. xvii. p. 696.

³ I have not met with the Canary Rock Moss in fructification, and cannot, therefore, positively state its botanical name. I found a similar lichen in commerce under the name of British Rock Moss. The thallus of both corresponds to that of *Parmelia perlata*, Ach.

4. TEST OF THE COLORIFIC PROPERTY OF LICHENS.—Hellot's test is maceration in a weak solution of ammonia (see *Rocella tinctoria*).

Another method is by testing an alcoholic tincture of the lichen with a solution of hypochlorite of lime. If the lichen possess any colorific power, a fugitive red colour is produced.

Dr. Stenhouse¹ proposes to estimate the quantity of colorific matter in lichens by means of a solution of hypochlorite of lime. Any convenient quantity of the lichen (say one hundred grains) may be cut into very small pieces, and then macerated with milk of lime till all the coloring principle is extracted. Three or four macerations are quite sufficient for this purpose, if the lichen has been sufficiently comminuted. The clear liquors should be filtered and mixed together. A solution of bleaching powder of known strength should then be poured into the lime solution from a graduated alkalimeter. The moment the bleaching liquor comes in contact with the lime solution of the lichen, a blood red colour is produced, which disappears in a minute or two, and the liquid has only a deep yellow colour. A new quantity of the bleaching liquid should then be poured into the lime solution, and the mixture carefully stirred. This operation should be repeated so long as the addition of the hypochlorite of lime causes the production of the red colour; for this shows that the lime solution still contains unoxidized colorific principle. Towards the end of the process, the bleaching solution should be added by only a few drops at a time, the mixture being carefully stirred between each addition. We have only to note how many measures of the bleaching liquor have been required to destroy the colouring matter in the solution, to determine the amount of the colorific principle it contained. The following are the results of trials with the same test liquors upon four varieties of lichen:—

	Measures.
Angola lichen required	200 = 1.00
American lichen	120 = 0.60
Cape lichen	635 = 0.17
<i>Lecanora tartarea</i> , from Germany near Giessen	625 = 0.12

The amount of colorific principle in a lichen may also be directly determined by extracting the lichen with milk of lime, by precipitating by means of acetic acid, collecting the precipitate on a weighed filter, drying it at the ordinary temperature, and then weighing it.

5. MODE OF EXTRACTING THE COLORIFIC PRINCIPLES FOR TRANSPORT.—Dr. Stenhouse suggests the following method: cut the lichens into small pieces, macerate them in wooden vats with milk of lime, and saturate the solution either with muriatic or acetic acid. The gelatinous precipitate is then to be collected on cloths, and dried by a gentle heat.

In this way almost the whole colorific matter can be easily extracted, and the dried extract transported at a small expense from the most distant inland localities, such as the Andes or Himalayas.

Dr. Stenhouse has kindly furnished me with the following table of the lichens, and their colorific principles and coloured products:—

LICHENS.		COLORIFIC PRINCIPLES.		COLOURING PRINCIPLES.		AUTHORITY.
Commercial names.	Locality.	Names.	Formulae.	Names.	Formulae.	
S. American Orchella-weed .	Lima, &c.	Alpha Orsellie acid	$C^{22}H^{13}O^{12}+HO$	Orceine	$C^{18}H^{10}NO$	Stenhouse.
Cape Orchella-weed	Cape of G. Hope	Beta Orsellie acid	$C^{24}H^{18}O^{14}+HO$	Ditto	Ditto	Stenhouse.
Angola Orchella-weed	Angola, Africa	Erythric acid	$C^{20}H^{10}O^9+HO$	Ditto	Ditto	Stenhouse.
Perelle Moss (<i>Lecanora parvella</i>)	Switzerland	Lecanoric acid	$C^{18}H^8O^8$	Ditto	Ditto	Schunck.
Tartareous Moss (<i>L. tartarea</i>)	Norway	Gyrophoric acid	$C^{26}H^{18}O^{16}$	Ditto	Ditto	Stenhouse.
Pustulatus Moss (<i>Gyrophora pustulata</i>)	Norway	Ditto	Ditto	Ditto	Ditto	Stenhouse.
Rugged hoary Lichen (<i>Evernia prunastri</i>)	Scotland	Evernicacid	$C^{34}H^{12}O^{12}+HO$	—	—	Stenhouse.
Usnea (<i>florida</i> , <i>plicata</i> , and <i>hirta</i> , &c.)	Germany	Usnic acid	$C^{28}H^{12}O^{14}$	—	—	Rochleder and Heldt.
Rein-deer Moss (<i>Cladonia rangiferina</i>)	—	Ditto	Ditto	—	—	Rochleder and Heldt.
Ramalina (<i>fastigiata</i>) [<i>calicaris</i>]	—	Ditto	Ditto	—	—	Rochleder and Heldt.

¹ *Phil. Trans.* for 1848.

14. ROCCELLA TINCTORIA, De Cand.—DYER'S ORCHELLA WEED.

Sex. Syst. Cryptogamia, Algæ.

HISTORY.—Theophrastus,¹ Dioscorides,² and Pliny,³ notice a plant which they respectively call πόντιον φύκος, φύκος θαλάσσιον, and *phycos thallassion*, i. e., *fucus marinus*. They state that it grew near the ground on the rocks of Crete, and was used for dyeing purple; and Dioscorides says that some persons imagine that the paint (*fucus*) used by women was this plant, but, he adds, it was a root bearing the same name.⁴

The *phycos thallassion* has been usually assumed to be *Roccella tinctoria*, and not, as the ancients state, a sea-weed.⁵ Bory de St. Vincent⁶ even thinks that the ancients made their celebrated purple dye, brought from the isles of Elishah,⁷ with the *R. tinctoria*, which he therefore calls *R. purpura-antiquorum*.

Early in the 14th century, the art of dyeing wool with *Roccella tinctoria* was made known at Florence by one of the descendants of a German nobleman named Ferro or Fredrigo. It is said that he accidentally discovered, in the Levant, the colour obtained by the action of urine on this plant, there called *respio* or *respo*, and in Spain *orciglia*; and that his family received the name of *Oricellarii*, altered to *Rucellai*, from this useful invention. From the latter term the generic name *Roccella* is supposed to be derived.⁸

BOTANY. Gen. Char.—*Thallus* coriaceous-cartilaginous, rounded or plane, branched or laciniated. *Apothecia* orbicular, adnate with the thallus; the disk coloured, plano-convex, with a border at length thickened and elevated, formed of the thallus, and covering a sublentiform, black, compact, pulverulent powder concealed within the substance of the thallus (*Hooker*).

Sp. Char.—*Thallus* suffruticose, rounded, branched, somewhat erect, grayish-brown, bearing powdery warts [*soredia*]. *Apothecia* flat, almost black and pruinose, with a scarcely prominent border (*Hooker*).

β. *R. tinctoria* β *hypomecha*, Ach.; *R. hypomecha*, Bory. *Thallus* terete, filiform, very long, simplish, subconjugate, prostrate, pendulous.—Cape of Good Hope; Mauritius.—2 to 5 inches long: the thallus geniculate where the apothecia are developed (*Bory*): the apothecia by age lose the thalloid margin and become convex, naked, smooth, and black (*Ach.*).

γ. *R. dichotoma*, Ach., has a terete ash-gray, brownish thallus, with longish dichotomous branches.

Hab.—Maritime rocks of the eastern Atlantic islands (the Madeira isles, the Azores, the Canaries, and the Cape de Verd isles); western coast of South America (on porphyry near Riobamba in Colombia, and on the sea-shore near Chancay in Peru—Humboldt);⁹ Bourbon; extreme south of England, Guernsey, Portland Island, and the Scilly Islands.

In commerce several other species, or varieties of the above species, are met with. The most important are the following:—

R. fuciformis, De Cand., *Ach. Syn.*, p. 244. *Hooker, Engl. Fl.*, vol. v. part 1, p. 222. *Lichen fuciformis*, Linn. Flat leaved orchella weed.—*Thallus* flat, branched, nearly upright, grayish-white, bearing powdery warts. *Apothecia* pruinose, bordered (*Hooker*). Maritime rocks with *R. tinctoria*; Canaries; from Cherbourg to Mogadore; St. Malo; South of England.

R. fuciformis β *linearis*, Ach. Spain, Sumatra, the Dezertas (Madeira).

R. phycopsis, Ach., is also perhaps a variety of *R. fuciformis*. It is intermediate in character

¹ *Hist. Plant.* lib. iv. cap. vii. p. 82, ed. Heinsii, 1613.

² Lib. iv. cap. c. p. 283, ed. Saraceni, 1598.

³ Lib. xxvi. cap. lxxvi.; and lib. xxxii. cap. xxii. ed. Valpy.

⁴ Endlicher (*Enchiridion Botanicum*, p. 4, 1841) says, that one of the Algæ, viz., *Rytiphlea tinctoria*, Ag. yields a red colour, the *fucus* of the ancients.

⁵ Beckmann, *Hist. of Invent. and Discov.* translated by Wm. Johnston, vol. i. p. 59, 1797.

⁶ *Essais sur les Isles Fortunées*, 1803; *Dict. Classiq. d'Hist. Nat.* xiv. 1828.

⁷ Ezekiel, ch. xxvii. v. 7.

⁸ *Synops. Plant. Æquin.* i. 50.

⁹ Beckmann, *op. citato*.

between the latter and *R. tinctoria*. Its thallus is somewhat flattened (terete-compressed), and much branched; the divisions being somewhat fastigiate, rarely more than an inch long, and very farinaceous.

R. FLACCIDA, Bory. Branches somewhat cylindrical, filiform, very broad, pendulous, whitish. Mauritius.

R. MONTAGNEI, Belanger, *Voy. aux Indes Orient.* Pl. 13, Fig. 4 [no date]. *Thallus* coriaceous, flaccid, flat, entire and broad at the base, at length dichotomously (rarely trichotomously) lacinate, pale glaucous, sorediferous. *Apothecia* marginal, somewhat pedicellate, with a black convex pruinose disk, and persistent margin.—On the trunks of Mango trees (*Mangifera indica*) in India; especially at Pondicherry. This species, and *R. pygmæa*, D. R. and Mont., which grows in Algeria, are remarkable for growing on the trunks of trees; the others are found on maritime rocks.

Fig. 170.

Fig. 171.

Fig. 172.

Fig. 173.



Roccella or Orchella Weed.

Fig. 170. *Roccella tinctoria*.

a. Thallus with apothecia.

b. Ditto with soredia.

c. Portion of thallus with three more developed apothecia.

d. *R. tinct.* var. *dichotoma*.Fig. 171. *Roccella fuciformis*.Fig. 172. *Roccella Montagnei*.

a. Thallus with soredia.

b. Ditto ditto (magnified).

Fig. 173. *Roccella phycopsis* with soredia.

COMMERCE.—All the species and varieties of *Roccella* found in commerce bear the general appellation of *Orchella weed*; but they are distinguished by the name of the country from which they are imported. The following is a list of the sorts which, within the last few years, have been found in the London market; those marked with the asterisk (*) I have myself examined, and possess samples of—

*Angola Orchella weed.

Mauritius “

*Madagascar “

*Barbary (Mogadore) ditto.

*Cape of Good Hope ditto.

*Canary Orchella weed.

Cape de Verde “

*Western Island “

*Madeira (Dezertas) ditto.

*Lima (thick) Orchella weed.

*Lima (thin) “

Corsica and Sardinia “

In 1838, 567 cwts.; in 1839, 6494 cwts.; and in 1840, 4175 cwts. of *Orchella weed* paid duty.

PHYSICAL PROPERTIES.—Having fully described the botanical characters of the different species of *Roccella*, it will be unnecessary here to describe minutely the different commercial sorts.¹

The commercial kinds of *Orchella weed* may be conveniently arranged in three divisions, as follows:—

1. *Orchella weeds having a cylindrical tapering thallus*.—These consist usually of *Roccella tinctoria*, and perhaps *R. flaccida*, Bory. In one case (Cape of Good Hope orchella) the plant is *R. hypomecha*, a mere variety of *R. tinctoria*. Occasionally, flattened orchella weeds are found intermixed: these may be regarded as accidental.

¹ For figures of the microscopic structure of the *Roccella tinctoria*, the reader is referred to Link's *Icones Selectæ Anatomico-Botanice*, Berl. 1841, 3tes Heft, Taf. vi.

a. *Canary Orchella Weed. Roccella tinctoria*.—Formerly the most esteemed sort of *Orchella*. Thallus filiform, seldom exceeding in thickness a pin, and in length an inch and a half. Colour from pale-yellowish gray to dark brown.

β. *Western Island Orchella Weed; St. Michael's Orchella Weed. Roccella tinctoria*.—Similar to the preceding; but less valuable as a dye-stuff.

γ. *Barbary Orchella Weed; Mogadore Orchella Weed. Roccella tinctoria*.—Somewhat smaller than the preceding sorts, and less valuable as a dye.

δ. *Lima thick Orchella Weed; South American thick Orchella Weed. Roccella tinctoria? R. flaccida*, Bory?—A very handsome lichen, brought from Lima and other parts of the west coast of South America. Distinguished from the other sorts by its large size; usually several, sometimes six or eight, inches long: its thickness from that of a crow-quill to that of a goose-quill. Thick tubercular excrescences are frequently found on it. It has a very leathery, sometimes a cartilaginous whitish appearance. Its quality as a dye is considered good, and superior to the preceding sorts.

ε. *Cape of Good Hope Orchella Weed. R. tinctoria β hypomecha*, Ach.—A large lichen, though rather smaller than the preceding. Remarkable for its white or gray-white appearance: many of the divisions of the thallus are geniculated. As a dye its quality is very bad.

2. *Orchella Weeds have a flat (plane) or compressed thallus*. These consist of *R. fuciformis*, and, perhaps, in some cases, of *R. Montagnei*.

ζ. *Angola Orchella Weed. R. fuciformis*.¹—Thallus very flat, seldom exceeding an inch and a half or two inches in length: in breadth (except at the fork or division) rarely more than one-sixth of an inch. Colour greenish or yellowish-gray. As a dye-stuff it is the most valuable of all the *Orchella* weeds.

η. *Madagascar Orchella Weed. R. fuciformis*.—Smaller, but in other respects similar to the preceding sort. Somewhat less valuable than the Angola sort.

θ. *Lima thin Orchella Weed. R. fuciformis?*—Somewhat more rounded or less flat than the preceding, which it in other respects very much resembles.

3. *Mixed Orchella Weeds, consisting of both flat and round Orchella Weeds.*

ι. *Madeira Orchella Weed. R. tinctoria and R. fuciformis β linearis*, Ach. Gathered on the *Dezertas*, near Madeira. The round and terete thalli resemble the *Canary Orchella*. The flattened thalli are thicker than those of the Angola sort.

COMPOSITION.—A qualitative analysis of *Roccella tinctoria* was made by Fr. Nees v. Esenbeck,² who found in it a *brown resin* (soluble in alcohol and ether, and becoming brownish red with ammonia), *wax*, *glutinous matter*, *insoluble starch*, *yellow extractive*, *yellowish-brown gummy matter*, *lichen-starch*, *tartrate* and *oxalate of lime*, and *chloride of sodium* from the adherent sea water.

The nature of the colorific principles of the *Orchella* weeds (*Roccella*) of commerce has been the subject of several analytical investigations; the most important of which are those of Heeren,³ in 1830; of Kane,⁴ in 1840; of Schunck,⁵ in 1841, and also in 1846; of Rochleder and Heldt,⁶ in 1843; of Knop,⁷ in 1844; and of Stenhouse,⁸ in 1848.

Robiquet⁹ has thrown much light on the subject by his investigations into the nature of the colorific principle of *Variolaria dealbata*.

The only constituents of the *Orchella* weeds which will require separate notice are the colorific principles; and in describing these I shall follow Stenhouse.

1. **ALPHA-ORSELLIC ACID** (*Stenhouse*); *Colorific principle of Lima thick Orchella Weed (Roccella tinctoria)*.—Obtained by macerating the lichen in milk of lime, and then adding excess of hydrochloric acid to the filtered solution. A white gelatinous precipitate is obtained, which, when washed, dried, dissolved in warm alcohol, and the solution allowed to cool, yields stellate prismatic crystals of alpha-orsellie acid. It is nearly insoluble in cold water, but sparingly soluble in boiling water; pretty soluble in cold alcohol and ether, and readily so in boiling

¹ Dr. Scouler (in Dr. Stenhouse's paper on the Lichens in the *Phil. Trans.* for 1848, p. 72) has pronounced the Angola *Orchella* Weed to be *R. Montagnei* of Belanger. My own examination of it led me to believe that it was *R. fuciformis*. I therefore submitted samples of it to Sir W. Hooker and Mr. Bennett, of the British Museum, both of whom have declared it to be one of the numerous varieties of *R. fuciformis*.

² Brandes's *Archiv. d. Apothekerverein*, Bd. xvi. S. 135.

³ Schweigger's *Jahrb. d. Chem.* Bd. lix. S. 313, 1830; Buchner's *Repertorium*, Bd. xxxviii. S. 21.

⁴ *Phil. Trans.* for 1840, p. 273.

⁵ *Ann. d. Chem. u. Pharm.* Bd. xli. S. 157, 1842; and *Memoirs of the Chemical Society of London*, vol. iii. p. 144, 1846.

⁶ *Ann. d. Chem. u. Pharm.* Bd. xlviii. S. 1, 1843.

⁷ *Ibid.* Bd. xlix. S. 102, 1844.

⁸ *Journ. de Chim. Méd.* t. v. p. 324, 1829; *Journ. de Pharm.* t. xxi. pp. 269 and 357, 1835.

⁹ *Phil. Trans.* for 1848, p. 63.

alcohol. It reddens litmus, and forms crystallizable salts with the alkalies and earths. Its most characteristic reaction, by which its presence can be very readily detected, is the deep blood-red colour which it instantly strikes with a solution of hypochlorite of lime; the colour soon changes to yellow which gradually also disappears. A solution of orsellic acid in ammonia, on exposure to the air, soon assumes a bright-red colour, which gradually becomes darker and purple coloured. The rational formula for alpha-orsellic acid is $C^{32}H^{15}O^3 + HO$.

2. BETA-ORSELLIC ACID (*Stenhouse*); *Colorific principle of Cape of Good Hope Orchella Weed* (*Rocella hypomecha*).—Is intermediate in its properties between alpha-orsellic acid and erythric acid, but approaches the former more closely. It is crystallizable, and its solution yields a fugitive blood red colour with hypochlorite of lime. Its ammoniacal solution also becomes red in the air. The rational formula of the hydrated acid is $C^{31}H^{17}O^{14} + HO$.

3. ERYTHRIC ACID (*Schunck and Stenhouse*); *Colorific principle of Angola and Madagascar Orchella Weeds* (*Rocella fuciformis*).—By macerating the lichen in milk of lime, as before stated, Stenhouse obtained 12 per cent. of crude erythric acid. It is a feeble acid than alpha- and beta-orsellic acids; but it agrees with these acids in being crystallizable, and in yielding red-coloured compounds with ammonia, and also in its reaction with hypochlorite of lime. The formula of the hydrated acid is $C^{20}H^{10}O^9 + HO$.

CHEMICAL CHARACTERISTICS.—The aqueous decoction of Orchella weed forms a copious precipitate with diacetate of lead, and has its colour deepened by alkalies. Digested in a weak solution of ammonia, in a corked phial, at a heat not exceeding $130^{\circ} F.$, the plant yields a rich violet-red colour. This is *Helot's test* for the discovery of a colorific property in lichens.¹ By adding a solution of hypochlorite of lime to an alcoholic tincture, or to an alkaline infusion of the lichen, a fugitive blood-red colour is produced.

PHYSIOLOGICAL EFFECTS.—Mucilaginous, emollient, and demulcent.

USES.—In the Mauritius it is employed in decoction to alleviate cough. In Europe it is only employed as a colorific agent.

1. LACMUS.—LITMUS.

SYNONYMES.—*Turnsole in cakes* (*tournesol en pains; tournesol en pierre*); *Dutch turnsole; lacca musica, musiva, vel musci; lacca cærulea*.

HISTORY.—The manufacture of litmus was probably discovered by the Dutch about the latter end of the seventeenth century.²

PREPARATION.—Litmus is obtained by the united influence of water, air, ammonia, and either potash or soda, on any of the tinctorial lichens capable of yielding orchil. If the potash or soda be omitted, the product is not litmus, but orchil.

The manufacture of litmus has been described by Ferber,³ by an anonymous writer,⁴ by Morelot,⁵ and by Amédée Gélis.⁶ From their accounts it appears that the lichen is macerated for several weeks, with occasional agitation in a mixture of urine, lime, and potashes, in a wooden trough under shelter. A kind of fermentation takes place, and the lichen becomes first reddish, and subsequently blue. When the pulp has acquired a proper blue colour, it is placed in proper moulds, and the cakes thus procured are subsequently dried.

The moulds are either of steel or brass, and consist of two parts: the lower one divided into rectangular cells, and the upper one supporting a series of metallic rods bearing small metallic disks, so arranged as to accurately fit the cells of the lower piece.

¹ Berthollet *On Dyeing*, by Ure, vol. ii. p. 184; also, *Proceedings of Comm. of Agricult. of Asiatic Society*, April 8th, 1837.

² Litmus is not mentioned by, and, therefore, was probably unknown to, Caspar Bauhin (*Pinax*, 1671), and to Dale (*Pharmacologia*, 3tia ed. 1737). The earliest authors in whose works I have found it mentioned are, Pomet (*History of Drugs*, Eng. ed. 1712), and Valentine (*Hist. Simpl.* 1716).

³ *Neue Beytrage zur Mineralgeschichte verschiedener Lander*, Bd. i. S. 378, Mettau, 1778. Ferber describes the process as practiced at Amsterdam. He says that the pulp is ground in a mill, and forced through a hair cloth, before it is placed in the moulds.

⁴ Nicholson's *Journal of Nat. Phil. Chem. and the Arts*, vol. ii. p. 311, 1799. The notice of litmus is a translation from an article in the *Journal du Commerce*. The lichen is said to be ground in a mill, and sifted through a brass wire sieve before maceration. The moulds are described as being $1\frac{1}{4}$ inches by 8-10ths of an inch.

⁵ *Mémoire sur le Lichen François*, vulgò *tournesol en pain*, in the *Mém. de la Soc. Méd. d'Emulation*, t. v. p. 281.

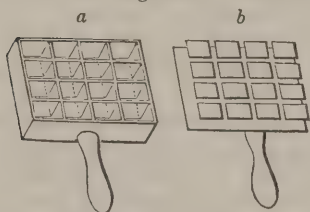
⁶ *Journ. de Pharm.* t. xxvii. p. 476, 1840.

The lower piece is immersed in the pulp with which they are filled, and the excess of pulp is then scraped off by means of a wooden spatula. The upper piece being then applied, the disks enter the cells, and force out the moulded cakes of litmus.

It appears from Gélis' experiments, that any of the lichens which serve for the production of orchil may be used in the preparation of litmus.¹

The urine serves for the production of carbonate of ammonia, and the lime employed abstracts the carbonic acid.

Fig. 174.



Moulds used in making Litmus.

a. The lower or cell-piece.

b. The upper piece.

The Dutch manufacturers add chalk or sulphate of lime, and some siliceous or argillaceous substance, to give body and weight to the litmus. Indigo is also introduced, doubtless for the purpose of increasing the blue colour of the cakes.

DESCRIPTION.—Litmus is imported from Holland, in the form of small, rectangular, light, and friable cakes of an indigo-blue colour. Examined by the microscope we find sporules, and portions of the epidermis and mesothallus of some species of lichen, moss leaves, sand, &c. The odour of the cakes is that of indigo and violets. The violet odour is acquired while the mixture is undergoing fermentation, and is com-

mon to all the tinctorial lichens. It has led some writers into the error of supposing that the litmus-makers use Florentine orris in the manufacture of litmus. The indigo odour depends on the presence of indigo in the litmus cakes.

COMPOSITION.—An accurate and complete analysis of litmus is yet a desideratum. In 1840, Dr. Kane² submitted it to examination, and obtained from it four colouring principles, to which he gave the names of *erythrolein*, *erythrolitmine*, *azolitmine*, and *spaniolitmine*. These, in their natural condition, are red, and the blue of litmus, he says, is produced by combination with a base. "There are, properly speaking," he adds, "only two characteristic colouring matters in litmus—the erythrolitmine and the azolitmine; for the erythrolein is coloured crimson purple only by alkalies, and the spaniolitmine occurs but very seldom. In the litmus of commerce these colouring substances are combined with *lime*, *potash*, and *ammonia*, and there is mixed up in the mass a considerable quantity of *chalk* and *sand*."

Gélis³ has published some interesting observations on litmus. He says that litmus owes its colour to *four different coloured products*, which he designates by the letters A, B, C, and D. The ash of litmus he found to contain *carbonate of potash*, *carbonate or sulphate of lime*, *alumina*, *silica*, *traces of oxide of iron*, *chlorine*, *sulphuric acid*, and *phosphoric acid*.

I shall provisionally call the proper colouring matter of litmus derived from the lichen, *lichen-blue*.

LICHEN-BLUE; *Litmus Blue*. By these terms I understand the peculiar blue colouring matter of litmus, which is soluble in water, and is reddened by acids. It is probably either some modification of *orceine*, or some allied principle. It may perhaps be a mixture or compound of several colouring principles.

It is soluble in both water and spirit, yielding a coloured solution, which, in the concentrated state, has a purple colour when viewed by transmitted light; but in the dilute state it is pure blue. Viewed by transmitted candle-light it has a reddish colour. An aqueous infusion of

¹ Ferber saw the *Rocella* lichen used at Amsterdam. Morelot stated that *Variolaria orcina* yielded it. Nees and Ebermaier (*Handb. d. Med. Pharm. Bot. Bd. i. S. 49*); and Thomson (*Org. Chemistry*, p. 284), on the other hand, say that *Lecanora tartarea* is employed.—An orchil-maker, under my care in the London Hospital, told me that he had been accustomed to make litmus of pipe clay, starch, soda, and orchil liquor; and he gave me some specimens of it thus prepared. Gélis prepared it with *Rocella tinctoria* (in the scutelliferous state), *Rocella fuciformis*, and the mixture of *Lecanora parella*, *g. pallidescens*, and *Isidium corallinum*, sold under the name of *Orseille d'Auvergne*; but the last-mentioned plants yielded a less fine product than the others.

² *Phil. Trans.* for 1840, p. 298.

³ *Journ. de Pharmacie*, t. xxvii. p. 483, 1840.

litmus neither reddens turmeric paper nor occasions a precipitate with a solution of chloride of calcium. It contains, therefore, no free alkali or alkaline carbonate.

It is reddened by acids; and also by many of the metallic salts—as corrosive sublimate, sulphate of copper, sulphate of iron, &c. The infusion of litmus, which has been reddened by acids, has its blue colour restored by alkalies, alkaline earths, the alkaline and earthy sulphurets, the alkaline carbonates, the soluble borates, the tribasic phosphate of soda, the alkaline cyanides, &c.

An infusion of litmus is decolorized by chlorine and by the alkaline hypochlorites. Certain deoxidizing agents also deprive it of colour; as sulphuretted hydrogen, hydrosulphuret of ammonia, sulphurous acid, the hyposulphites, nascent hydrogen (obtained by adding hydrochloric acid and zinc to an aqueous infusion of litmus), and the protosalts of iron. If an infusion of litmus be left in contact with sulphuretted hydrogen, in a well-stopped bottle, for a few days, the liquid is decolorized, but reacquires its colour by exposure to the air or oxygen gas.

CHARACTERISTICS.—The lichen-blue is an aqueous infusion of litmus, is distinguished from other vegetable blues by the action of acids and alkalies on it (see *supra*); for most vegetable blues and purples (as red cabbage juice, syrup of violets, &c.) are changed to green by alkalies, whereas, lichen-blue does not undergo this change.

If a lump of moistened litmus be laid on turmeric paper, the latter is reddened by it; but by the application of heat the redness disappears.

When litmus cakes are thrown into diluted hydrochloric acid, a copious effervescence ensues, and a solution of chloride of calcium is obtained.

If a cake of litmus be ignited in the outer cone of the flame of a candle, a whitish violet tint is communicated to the flame, indicative of the presence of potash.

If the ashes of litmus be thrown into diluted hydrochloric acid, violent effervescence takes place; a solution of chloride of calcium is obtained, and a quantity of siliceous sand remains undissolved.

IMPURITIES.—Inferior samples of litmus (including all those usually found in English commerce) contain indigo,¹ the presence of which in litmus cakes is proved by their odour; by the coppery lustre which they acquire when rubbed with the nail; by digesting them in oil of vitriol, by which a blue solution of sulphate of indigo is obtained; and by heating them in a watch glass or platinum capsule, by which indigo-vapour (characterized by its well-known odour and reddish violet colour) and crystals of indigo are obtained.

USES.—Litmus is employed as a test for acids and alkalies. The former communicate a red colour to blue litmus: the latter restore the blue colour of reddened litmus. (The action of various salts on litmus has been before stated.) If the litmus present be reddened by an unboiled, but not by a boiled, water, we may infer that the acid present is a volatile one; probably carbonic acid, or perhaps sulphuretted hydrogen. Reddened litmus may have its blue colour restored not only by alkalies, &c., as before mentioned, but also by carbonate of lime dissolved in water by a considerable excess of carbonic acid.

1. TINCTURA LACMI; Tincture of Litmus. (Litmus *one part*; Distilled Water *twenty-five parts*. M.)—Though called *tincture*, it is in reality an *infusion* of litmus. In order to preserve it, a portion (about $\frac{1}{10}$ th part) of spirit may be added to it. If required to be more concentrated, the proportion of litmus should be augmented. Some persons first bruise the litmus in a mortar, and then tie it up in a linen bag before steeping it in the water. By keeping in a closely-stopped bottle, its blue colour disappears, but is shortly restored on the admission of atmospheric air.

2. CHARTA EXPLORATORIA CÆRULEA; Blue Test Paper; Blue Litmus Paper.—This is prepared by dipping slips of paper in a strong and clear infusion of litmus; or by brushing the infusion over the paper.

Bibulous or unsized paper is usually preferred, on account of the facility with which it imbibes the liquid to be tested; and also because the alum which frequently enters into the composition of the size affects the colour of litmus. Professor

¹ See two papers by the author in the *Pharmaceutical Journal*, vol. ix. p. 12, 1849; and vol. x. p. 325, 1850.

Graham, however, recommends good letter paper; or, if the infusion is applied to one side only, thin and sized drawing paper. Faraday¹ recommends the infusion to be prepared from an ounce of litmus and half a pint of hot water. The Prussian Pharmacopœia of 1827 orders one part of litmus and four parts of water. Others employ one part of litmus and six parts of water.

In order to obtain *extremely delicate* test paper, the alkali in the litmus is to be almost neutralized by a minute portion of acid. To effect this, divide the filtered infusion of litmus into two parts; stir one portion with a glass rod which has been previously dipped into very dilute sulphuric acid, and repeat this until the liquid begins to look reddish: then add the other portion of liquid, and immerse the paper in the mixture.

Good litmus paper should be uniform in its colour, and neither very light nor very dark. When it has a purplish tint, it is a more delicate test for acids than when its colour is pure blue. When carefully dried, it may be preserved by wrapping it in stiff paper, and keeping it in well-stopped vessels in a dark cupboard or drawer.

Books of test papers, bound up like bankers' cheque-books, are sold in the shops, and are very convenient. They are about $1\frac{3}{4}$ inches long and $\frac{3}{8}$ ths of an inch wide. To preserve them they are kept in leathern cases.

Blue litmus paper is used to detect the presence of acids and of certain salts which react as acids.

3. *CHARTA EXPLORATORIA RUBEFACTA; Reddened Test Paper; Red Litmus Paper.* This is prepared with an infusion of litmus which has been slightly reddened by an acid. Blue litmus paper may be extemporaneously reddened by exposing it for a few seconds to the vapour of acetic acid; but for preserving, it is better to prepare the paper with litmus which has been reddened by a minute portion of dilute sulphuric acid: the acetic acid being objectionable, on account of its volatility.

Red litmus paper is employed as a test for alkalies and certain salts (see *supra*), which react as bases.

2. ORCHILLA.—ORCHIL-LIQUOR.

Two kinds of liquid or thin pulp called Orchil or Archil are met with: one termed *blue orchil*, the other *red orchil*. They are prepared as follows: *blue orchil* is prepared by steeping the lichens before mentioned (see pp. 70 and 71) in an ammoniacal liquor in a covered wooden vessel. *Red orchil* is made with the same liquor in common earthen jars placed in a room heated by steam, and called a *stove*. In one manufactory which I inspected, the ammoniacal liquor was prepared by distillation from a mixture of lime, impure muriate or sulphate of ammonia obtained from gas-works, and water; but some makers still employ stale urine and lime. Both kinds of Orchil sold in the shops are liquids of a deep reddish purple colour and an ammoniacal smell. Red and blue orchils differ merely in the degree of their red tint.

According to Dr. Kane, Orchil consists of *orcein*, *erythroleic acid*, and *azoxythrine*. To these must be added *ammonia*.

Orchil is employed merely as a colouring agent. It is used for dyeing, colouring, and staining. It is sometimes used as a test for acids.

3. CUDBEAR.

Cudbear is called by the Germans *Persio*.¹ The manufacture of this pigment was begun at Leith about the year 1777, by the late Mr. Macintosh of Glasgow, under the management of Dr. Cuthbert Gordon. From the latter gentleman's name the term *cudbear* (at first *Cuthbert*) originated.

¹ *Chemical Manipulation*.

² The word *persio* is probably derived from *persica*, on account of the resemblance of the colour of cudbear to that of a peach.

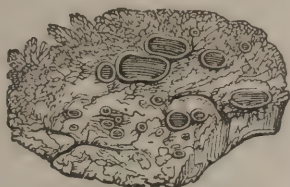
It is procured in the manner of Orchil, by the mutual action of some of the colorific lichens, air, and an ammoniacal liquor. *White Swedish* or *tartareous moss* (*Lecanora tartarea*) was formerly chiefly used in its manufacture. When the proper purplish red colour has been developed, the mixture is dried in the air and reduced to powder.

I have found in the shops two kinds of powder of cudbear, one called *red cudbear*, the other *blue cudbear*. Both are purplish red—but one is redder than the other. I have likewise met with *red* and *blue cudbear pastes*: but the term Orchil might with more propriety apply to these.

Cudbear is employed as a purple dye for woollen yarn; but the colour which it yields is fugitive. It is sometimes used for colouring pharmaceutical preparations; and it may be employed also as a test.

Cudbear paper is sometimes used as a test for acids and alkalies. "A paper prepared from an infusion of the best cudbear, without the addition of either alkali or acid, has a purple colour, and is affected by both acids and alkalies. It is convenient in alkalimetry, being already too red to be sensibly affected by carbonic acid, while it is distinctly reddened by the mineral acids."¹

Fig. 175.

*Lecanora tartarea.*

ORDER III. FUNGI, *Juss.*—FUNGALS.

FUNGACEÆ, *Lind.*

CHARACTERS—Plants consisting of a congeries of cells or filaments, or both variously combined, increasing in size in the more perfect species by addition to their inside, their outside undergoing no change after its first formation; chiefly growing upon decayed organic substances, or soil arising from their decomposition, frequently ephemeral, and variously coloured, never accompanied, as in Lichens, by reproductive germs of a vegetable green called gonidia; nourished by juices derived from the matrix. *Fructification* either spores attached externally, and often in definite numbers, to the cellular tissue, and frequently on peculiar cells called *sporophores* or *basidia*, which are in many cases surmounted by fine processes which immediately support the *spores*, and called *spicules* or *sterigmata*; or inclosed in membranous sacs or *asci*, and then termed *sporidia* (*Berkeley*, in *Lindley's Vegetable Kingdom*).

PROPERTIES.—Variable: we have esculent, medicinal, and poisonous species; and unfortunately there are no anatomical characters by which the poisonous are to be distinguished from the edible fungi.

They are remarkable for containing a very large proportion of water; and for their dry matter being rich in nitrogen and phosphates. Among their proximate constituents are several alimentary principles (e.g. albumen, sugar, mannite, and mucilage), and some poisonous ones (*ergotin*, *tremellin*, and *amanitin*). The substance called *fungin*, formerly considered to be a nutritive principle, appears to agree with cellulose in its nature.

Sub-order I. GYMNOAMYCETES, *Endl.*

CONIOMYCETES, *Fries.*

CHARACTERS.—*Sporidia* naked (without any hymenium, perithecium, asci, or sporidiferous flocci), produced beneath the epidermis of plants or within the matrix (*Fries*).

PROPERTIES.—No medicinal substances are obtained from this sub-order. The *yeast plant*, which Turpin refers to the genus *Torula* (from *torus*, a twisted cord), is more probably an imperfect mucclinous fungus, and as such will be noticed hereafter (see sub-order *Hyphomycetes*). The *ergot-mould*, called, by the late Mr. E. J. Quekett, *Ergotætia abortifaciens*, and referred to this sub-order, is considered by Link and some other authorities to be a species of *Oidium*, and as such will be noticed subsequently (see sub-order *Hyphomycetes*).

¹ Graham, *Elements of Chemistry*, p. 925.

Sub-order II. HYPHOMYCETES, *Fries.*

CHARACTERS.—*Flocci* sporidiferous, naked (*Fries*).

PROPERTIES.—To this sub order (which is closely allied to *Conserveæ*, p. 51,) are referred the yeast plant, the ergot-mould, mother of vinegar, and some other plants interesting alike to the physician and pharmacist.

15. FERMENTUM CERVISIÆ.—BARM or YEAST.

(*Cerevisiæ Fermentum*, *L. D.*)

HISTORY.—Leaven and ferment have been known from the most remote periods. *Leaven* (or *sour dough*), called in Hebrew *seor*,¹ and *ferment*, termed in Hebrew *khametz*,² are both referred to in the Old Testament: the one applies to solids, the other to both solids and liquids. In the common version, however, both these Hebrew words are translated leaven.³ The Greeks appear to have used the term ζύμη in a general sense, to include both leaven and ferment. Dioscorides⁴ speaks of the medical properties of the *leaven of wheat* (ἀλευρων ζύμη), which Galen⁵ and Paulus⁶ simply call ζύμη. Pliny⁷ distinguishes *leaven* (*fermentum*) from *beer yeast* (*spuma cervisiæ*).

The history of the discovery of the vegetable nature of yeast is an interesting subject of inquiry. So long since as the year 1680, Leeuwenhoek⁸ described and figured the globules of beer-yeast. He was fully aware of its vegetable nature, but was ignorant of its power of vegetating or growing, and notwithstanding the high magnifying power which he used, he failed to detect the presence of the granules or nuclei in the interior of the yeast-cells.

In 1826, Desmazières⁹ published some observations on Persoon's genus *Mycoderma*, which he defined anew, and referred to Gaillon's class of infusory animals, called *Nemazozaria* (now placed among *Algæ*). He described a *Mycoderma vini*, *glutinis farinulæ*, *multi-juniperini*, *multi-cervisiæ*, and *cervisiæ*. The latter is frequently considered to be the yeast-plant; but Desmazières confounded two things which deserve to be considered entirely distinct, namely, the yeast-plant, properly so called (the *Torula Cerevisiæ* of Turpin), and a larger filamentous confervoid plant, to which more strictly the name of *Mycoderma Cerevisiæ* of Desmazières should be confined.

To Cagniard-Latour is due the credit of establishing the real nature of yeast. During the years 1835 and 1836, he communicated to the *Société Philomathique* some researches on ferments, which were published in the journal called *l'Institut* (Nos. 158, 159, 164, 165, 166, 167, 185, and 199); and on the 12th of June, 1837, he presented to the Academy of Sciences his *Mémoire sur le Fermentation Vineuse*, a notice of which appeared in the *Comptes Rendus* of that period. The report¹⁰ on this memoir, drawn up by Turpin, in the name of himself, Thenard, and Becquerel, was made to the Academy in July, 1838 (*Comptes Rendus*); and the memoir itself was printed in the 68th volume of the *Annales de Chimie et de Physique*, 1838.

About the same time, Schwann¹¹ was occupied in investigations on this sub-

¹ Hence the German *sauer* and English *sour*.

² The sour fermented mare's milk used by the Tartars appears to have derived its name, *koumiss*, from the Hebrew *khametz*.

³ In *Exodus*, xiii. 7, the terms *seor* and *khametz* occur together, and are evidently distinct. "Unleavened things (*matzah*) [ἄζυμα] shall be consumed during the seven days, and there shall not be seen with thee fermented things [ζυμωτόν], and there shall not be seen with thee leavened mass [ζύμη]."—(*Biblical Cyclopædia*, vol. ii. pp. 236-7.) The interpolated Greek words are from the Septuagint.

⁴ Lib. ii. cap. 107.

⁵ Paulus Ægineta, trans. by F. Adams. Syd. Soc. Ed. vol. iii. p. 126.

⁶ *Hist. Nat.* lib. xviii. cap. 12 and 26; lib. xxii. cap. 82. Ed. Valp.

⁷ *Arcana Naturæ delecta*, p. 1, et seq. ed. nov. Lugd. Bat. 1722.

⁸ Desmazières's observations were first published at Lisle. They were afterwards reprinted in the *Annales des Sciences Naturelles*, t. x. p. 42, 1827.

⁹ A translation of this report appeared in Jameson's *Edinburgh New Philosophical Journal*, vol. xxv.

¹¹ Poggendorff's *Annalen der Physik*, Bd. xli. p. 184, 1837.

ject, but his observations were not published until 1837. He denied that the organized being found in fermenting liquids is one of the infusoria, as Desmazières had supposed, but asserted that it is undoubtedly a plant, and that it has great resemblance to many jointed fungi. Meyen, who examined it at Schwann's request, agreed as to its vegetable nature, and considered that the only doubt which could exist respecting it was, whether it was an algal or a fungus, but its deficiency in green pigment led him to regard it as a fungus. The filamentous fungus found in saccharine solutions which are undergoing fermentation, Schwann, therefore, proposed to call the *sugar-fungus* (Zuckerpilz). Meyen¹ adopts Schwann's proposal, and refers to three species of *Saccharomyces*, viz., *S. vini*, *S. cerevisiæ*, and *S. pomorum*.

In 1837, Kützing² described and figured the yeast-plant.

On the 20th of August, 1838, Turpin³ read to the Academy of Sciences at Paris, his valuable *Mémoire sur la Cause et les Effets de la Fermentation Alcoolique et Acetuse*.

The notion that yeast was an organized being, in fact a living plant, was at first strongly opposed by Berzelius and Liebig;⁴ but was soon adopted by the eminent chemist Mitscherlich.⁵

BOTANY.—The substance called yeast is a mass of microscopic cryptogams.

The organization and vitality of yeast are demonstrated by the *form and structure* of its particles, as determined by the microscope; by their *chemical composition*; by their *reproductive power*, as proved by the generation of yeast during the fermentation of beer; and lastly, by the *effects* of mechanical injuries,⁶ of heat and cold,⁷ and of chemical and other poisons.⁸

Kützing,⁹ who is a believer in the convertibility of some of the lower algal into species, or even genera, of a higher organization, is of opinion that yeast is an algal in its lowest, but a fungus in its highest, grade of development.

It is more probable, however, that this plant is a fungus in all stages of its existence; and that what we know as yeast is either a mass of sporidia or the separated joints of the spawn or mycelium of a fungus whose more perfect state is at present undetermined, but which is probably a mucedinous fungus, perhaps allied to *Penicillium*. In the present state of uncertainty, I have thought it preferable to design-

¹ *Report on the Progress of Vegetable Physiology during the year 1837*, translated by W. Francis, pp. 63-84, London, 1839.

² *Journal für praktische Chemie*, Bd. xi.

³ *Mémoire de l'Académie Royale des Sciences*, t. xvii. 1840.

⁴ In Liebig's *Annalen der Pharmacie*, vol. xxix. p. 100, 1839, a satirical paper (*The Mystery of Vinous Fermentation unfolded*) was published, representing yeast to be an infusory animal which fed on sugar, and evacuated by the alimentary canal spirit of wine, by the urinary organs carbonic acid! In his *Chemistry in its Application to Agriculture and Physiology*, edited by Dr. Playfair, 2d edition, 1842, Liebig declares yeast to be a body in a state of decomposition, and states that the idea of its reproducing itself, as seeds reproduce seeds, cannot for a moment be entertained. But in the third edition of his *Animal Chemistry* (edited by Dr. Gregory, 1846) he does not attempt to deny the vegetable nature of yeast, though he thinks that investigation into the nature of this substance is not yet completed.

⁵ See the *Report of the Academy of Sciences at Berlin* for February 1843, quoted in the translation of Link's *Report on the Progress of the Physiological Botany*, published by the Ray Society, p. 428, 1846.

⁶ A very curious fact was mentioned to me by the importer of German and Dutch yeast, in Finch-lane, Cornhill, London: it is, that mechanical injury kills or destroys yeast. Foreign yeast is imported in bags, and of these great care is requisite in their removal from place to place. If they be allowed to fall violently on the ground, the yeast is spoiled. A bruise, as a blow given to the bag, also destroys it. The men who make up the dried yeast into quarter-pound and half-pound balls for sale, are obliged to handle it very dexterously, or they injure and destroy it. In fact, falls, bruises, or rough handling, kill it, and the yeast which has thus been mechanically injured may be readily distinguished from good, unaltered yeast. Its colour becomes darker, somewhat like the change which an apple or pear undergoes when it becomes rotten; and, from being crumbly or powdery, it becomes soft, glutinous, sticky to the fingers like flour-paste, and soon stinks. I have submitted some of this injured or dead yeast to microscopical examination, but have been unable to detect any difference in its appearance from healthy yeast. The effect of mechanical injuries is also noticed by several writers. Thus Liebig (*Chemistry in its application to Agriculture*, by Dr. Playfair, p. 286, 3d ed. 1842) remarks that simple pressure diminishes the power of yeast to excite vinous fermentation.

⁷ Boiling for a short period injures, and for a long period destroys, the power of yeast to excite fermentation (Berzelius). Cold interrupts fermentation, apparently by rendering the yeast-plant torpid.

⁸ The power of yeast to excite vinous fermentation is arrested or destroyed by alcohol, acids, alkalies, various salts (chloride of sodium, bichloride of mercury, nitrate of silver, &c.), volatile oils, excess of sugar, &c. (See Berzelius and Liebig; also, Quevenne, in the *Journ. de Pharmacie*, t. xxiv. p. 3334, 1838.)

⁹ The following are, according to Kützing, the generic and specific characters of the Yeast-plant, which he calls *Cryptococcus Fermentum*, and refers to *Mycophæceæ* (Pilztanze), a sub-order of the Algæ.

CRYPTOCOCCUS.—Mucus hyaline globules, collected in an intermediate mucous stratum.
C. Fermentum.—Submersed: globules elliptical, solid, in the centre 1- or 2-punctate.

nate it by its more classical name (*Fermentum Cervisiæ*) than to adopt any of the following botanical names, which have been given to it: *Mycoderma Cervisiæ*, Desmazières; *Torula Cerevisiæ*, Turpin; *Cryptococcus Fermentum*, Kützing; *Saccharomyces Vini et Cerevisiæ*, Schwann and Meyen. For while *Mycoderma* is a spurious genus (Fries and the Rev. M. J. Berkeley), the yeast-plant has been declared, by an eminent fungologist, to be certainly no *Torula*; and as Kützing's notion of its algaecious nature is not admitted by botanists, his name of *Cryptococcus Fermentum* is scarcely admissible for it.

The Yeast-Plant.

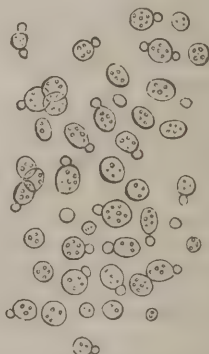
Fig. 176.



Fresh Yeast.

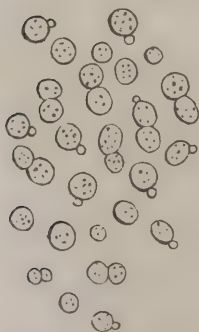
a. Cells overlapping and showing their transparency.
b. Micrometer scale, indicating one-hundredth of a millimetre, with a progressive series of small seeds or seminules, the two first beginning to become vesicular at the centre, the two others showing the thickness of the cells, and their interior small granules of variable size.

Fig. 177.



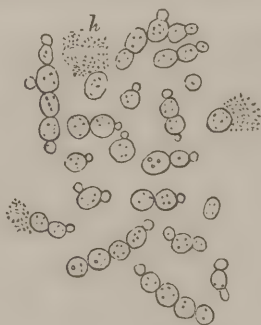
Yeast in wort for one hour.
(Cells beginning to germinate.)

Fig. 178.



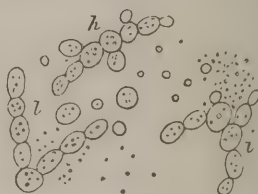
Yeast in wort for three hours.
(Cells double or didymous.)

Fig. 179.



Yeast in wort for eight hours.
(Cells united and converted into moniliform or jointed filaments.)

Fig. 180.



Yeast in a saccharine solution for three days.
h. The sporidia beginning to ramify and to evolve lateral buds.
i. Lateral branches composed of two joints.
l. An individual whose cell had evolved two branches.
The more or less small intermixed cells or granules are probably abortive.

When submitted to microscopic examination, yeast is found to consist of globose, or more or less ovoidal, ellipsoidal, or somewhat pyriform, transparent, nucleated cells, varying in size from $\frac{1}{7500}$ th to about $\frac{1}{2500}$ th of an English inch. The nucleus appears to me to consist of a mass of granules or nucleoli of unequal size: some of the larger ones are highly refractive, and probably contain oily or fatty matter. The nucleoli are called by Turpin, *globuline*.

Turpin spent a night in a brewery to examine the changes which the yeast under-

goes during the fermentation of beer. The fresh yeast had the appearance indicated in Fig. 176. In one hour after it had been added to the wort, he says that germination had commenced; the maternal cells had produced one or two buds or young cells (see Fig. 177). In three hours many of the cells were didymous, or double, the buds having attained the size of the maternal cells, and some of them had themselves begun to produce other buds or young cells (see Fig. 178). In eight hours the cells were arranged in rows, forming moniliform mucedinous plants, composed of several cells or joints, which varied somewhat in diameter and shape. Terminal, and in some cases lateral, buds or young cells were observed, showing that the plants were about to ramify. Some of the smaller rows were seen to explode and emit a fine powder, consisting of minuter globules (see Fig. 179). Turpin placed some yeast-cells in an aqueous solution of sugar, and in three days observed that jointed filaments, with lateral branches, were produced (see Fig. 180).

I have myself examined yeast at Messrs. Hanbury and Buxton's brewery at various stages of the fermentation of both porter and ale, from a few hours to many days. In the more advanced stages of fermentation, I observed the globules of yeast were frequently in strings, or rows, apparently forming moniliform often branched plants. But as the cells or joints were very readily separable, I could not satisfy myself that the adhesion was otherwise than mechanical, such as we see between the blood-disks when they arrange themselves in series like money-rolls, and such as we sometimes perceive even in inorganic amorphous precipitates. My experience agrees precisely with that of Schlossberger,¹ who states that he "never could perceive a budding or bursting of the yeast-cells, accompanied by a discharge of their contents, nor could I ever produce this by compression. These curious brachial and other adjustments of the cells of yeast to each other, appeared to me the work of chance." It is, however, proper to add, that the artificial rupture of the cells has been effected by Mitscherlich, who also confirms Turpin's observation of the budding of the yeast-cells (see p. 84).

ORIGIN.—It is well known that a pure solution of sugar will not undergo fermentation when exposed to the air, but a saccharine vegetable juice, which contains albuminous matter (as the juice of the grape), suffers spontaneous fermentation, and this process always begins with the formation of yeast-cells.

By some it is assumed that these arise from yeast-germs floating in the air, and which, meeting with a fit receptacle for their development in the vegetable juice, germinate and grow, and effect vinous fermentation. By others their production is ascribed to a *generatio primitiva*.

Turpin was of opinion that there are three sources or modes of production of the yeast-plant: 1st, the transformation of globuline into yeast-cells; 2dly, budding, or the separation of the joints of moniliform stems; 3dly, the escape of spores (*globulins seminulifères*) from the interior of the cells: Mitscherlich admits the two latter modes of growth.

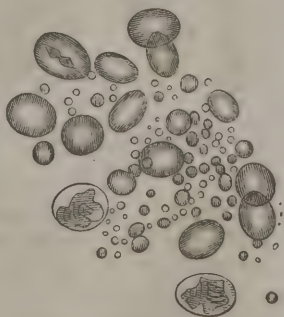
The amylaceous particles contained in the cells of the albumen of barley (see Figs. 181, 182) are called by Turpin *globuline*. The transformation of these into yeast-cells is, according to the same authority, the primitive origin of beer yeast. Dr. Lindley²

Fig. 181.



Cell from the albumen of barley, containing starch grains, called by Turpin *globuline*.

Fig. 182.



Turpin's *globuline* of barley.

¹ *Pharmaceutical Journal*, vol. v. p. 131, 1845.

² *Introduction to Botany*, p. 113, 4th ed. 1848.

partly confirms Turpin, for he states that he has seen these smaller granules sprout during fermentation; and he adds, that they have at that time lost all their starch, for iodine produces no sensible effect upon their colour.

Turpin states that 35 lbs. of dried or pressed yeast produced during the brewing of 5700 litres [about 14 butts] of beer 247 lbs. of dried or pressed yeast: that is, an actual increase of 212 lbs. of new yeast.

In the deposit from the porter refrigerator of Messrs. Truman and Hanbury's brewery, I have observed the forms deposited in Fig. 183, *c*, *d*, *e*, and *f*. These constitute the plant called by Desmazières the *Mycoderma Cervisæ*.

OCCURRENCE IN THE HUMAN BODY.—Yeast-cells have been found in the human body. Hannever detected them in the black coating of the tongue of a typhoid patient. They have also been discovered in the liquids of the œsophagus, stomach, and intestine. In some cases, probably, they may have been introduced by the beer drank by the patient; but, in other cases, their presence could not be accounted for in this way. As they are developed in the urine of diabetic patients, their occurrence in urine has been supposed to indicate the existence of sugar, but they have been found also in non-saccharine urine.¹

DESCRIPTION.—In commerce, three varieties of yeast are known and distinguished.

These are, brewers' yeast, dried yeast, and patent yeast.

1. *Brewers' yeast.*—In breweries, two kinds of yeast may be distinguished, namely, *upper* or *top yeast*, and *lower* or *bottom yeast*. These have been described by Mitscherlich.²

Top yeast consists of large cells, at the extremities of which small ones are developed. It appears, therefore, to be produced by buds. In Berlin, the most beautiful top yeast is obtained at a temperature of 77° F.

Bottom yeast consists of cells of various sizes, without any small globules attached to the large ones. It appears to be produced by the growth of small isolated granules (spores?), which Mitscherlich thinks have escaped from the yeast-cells which have burst and disburthened themselves of their contents. Bottom yeast is multiplied at a lower temperature than top yeast: Mitscherlich says, that the bottom ferment of Bavarian beer is produced at a temperature which must not exceed 48° F. nor go below 32° F. The bottom yeast sold at breweries is generally impure.

Brewers and bakers distinguish yeast according to the quality of the beer from which it is obtained. *Ale yeast* is the best and strongest; and is used for bread-making. *Porter yeast* is objected to by bakers, but is used in distilleries.

Small-beer yeast is said to be weak, but rapid in its effects, and is sometimes used in making rolls.

2. *Dried yeast.*—Under this name is sold a granular or pasty mass of yeast-cells, which have been separated from mechanically admixed solids, as well as from the supernatant fermented liquid, probably by filtration through linen cloths and subsidence. That which is sold in London is imported from Holland, Belgium, and Germany, and is commonly called *German yeast*. It comes over in hempen bags,

Fig. 183.



Mycoderma Cervisæ.

Desmazières.

¹ *Des Végétaux qui croissent aux l'Homme et sur les Animaux*, par M. Ch. Robin, Paris, 1847.

² Poggend. Ann. lix.; also, *Chem. Gazette*, vol. i. p. 568, 1843.

each holding half a hundred weight. If transported in casks it is apt to burst them, unless they are strongly iron-bound, by the quantity of carbonic acid which it evolves.

3. *Patent yeast*.—This might with more propriety be called *artificial yeast*. It is a watery liquid, containing yeast-cells, and which has usually been prepared purposely by the fermentation of an infusion of malt and hops. The hops probably contribute to prevent the liquid becoming rapidly sour. Turpin thinks that their oil may act as a stimulant in the development of the yeast-plant. I am informed by a baker that he prepares patent yeast for bread-making by mashing half a peck of ground malt with six gallons of water at 170° F.; then boiling the wort with half a pound of hops; and to the cooled liquid adding some brewers' yeast. In 24 hours the patent yeast is fit for use.¹ It rapidly turns sour in warm weather; and I am informed that bread made with it does not keep so well as that prepared with other kinds of yeast. It is in general use among bakers, especially those who use an inferior kind of flour.

Mr. Fownes² describes the following mode by which he prepared some artificial yeast: "A small handful of ordinary wheat-flour was made into a thick paste with cold water, covered with paper, and left for seven days on the mantle-shelf of a room where a fire was kept all day, being occasionally stirred. At the end of that period three quarts of malt were washed with about two gallons of water, the infusion boiled with some hops, and when sufficiently cooled, the ferment added. The results of the experiment were a quantity of beer (not very strong, it is true, but quite free from any unpleasant taste), and at least a pint of thick barm, which proved perfectly good for making bread."

COMPOSITION.—Yeast has been analyzed by Marcet,³ by Dumas,⁴ by Mitscherlich,⁵ by Mulder,⁶ and by Schlossberger.⁷

It consists of two parts, the *cell-walls*, composed of a kind of *cellulose*, and the *contents of the cells*, composed of a *proteine substance*, and probably *fat*, or *oil*.

1. *CELL-WALLS*.—By digesting yeast in a weak solution of potash, the contents of the cells are removed, and the membranous matter composing the cell-walls is left. In its composition it approximates to *cellulose* or *starch*.

	Atoms.	Eq. Wt.	Per Cent.	Mulder.	Schlossberger.	
					With chromate of lead.	With oxide of copper and chromate of potash.
Carbon	12	72	44.44	45.00	45.45	45.09
Hydrogen	10	10	6.17	6.11	6.87	6.60
Oxygen	10	80	49.38	48.88	47.68	48.31
Cellulose of yeast	1	162	99.99	100.00	100.00	100.00

2. *CONTENTS OF THE CELLS*.—According to both Mulder and Schlossberger, yeast-cells contain a substance allied to the *proteine bodies*.

	Schlossberger.	
	Mulder.	
Carbon	43.35	55.53
Hydrogen	6.56	7.50
Nitrogen	12.68	14.01
Oxygen	37.41	22.96
	100.00	100.00

Besides traces of *phosphorus* and *sulphur*.

Mulder regards the contents of the cells as being the *hydrated oxide of proteine*, $C^{40}H^{37}N^5O^{26} = C^{40}H^{31}N^5O^{12} + O^8 + 6HO$.

¹ Various receipts for making yeast are given in Webster's *Encyclopædia of Domestic Economy*, p. 760.

² *Pharmaceutical Journal*, vol. ii. p. 403, 1842.

³ Quoted by L. Gmelin, *Handb. d. Chem.* Bd. ii. S. 1100.

⁴ *Traité de Chimie appliquée aux Arts*, t. vi. p. 316, 1843.

⁵ *Lehrbuch d. Chemie*, 4 Aufl. S. 370 (quoted by Schlossberger).

⁶ *The Chemistry of Vegetable and Animal Physiology*, translated by Dr. Fromberg, p. 46; also, *Pharm.*

Central Blatt für 1844, S. 891.

⁷ *Ann. d. Chem. u. Pharm.* Bd. li. S. 193, 1844; also, *Pharm. Journal*, vol. v. p. 42, 1846.

It is probable that, besides a proteine body, the cells contain a *fatty, or oily substance*. Schlossberger states that he extracted a yellow oil from yeast by means of ether.

3. **ASHES.**—According to Schlossberger, the ashes of upper yeast amounted to 2.5; of lower yeast, to 3.5 per cent.

PHYSIOLOGICAL EFFECTS.—The effects of yeast on the animal economy are, if at all, not very obvious. The constituent of the cell-walls is insoluble, and therefore inert. The contents of the cells may, perhaps, be slightly nutritive. To the evolved carbonic acid have been ascribed the topical antiseptic effects of yeast.

The tonic and laxative effects ascribed to beer yeast, are probably referable to the fermented malt liquor in which the yeast-cells are usually contained and exhibited (see *Wort*).

USES.—Yeast is employed both for medicinal and chemical purposes.

As a medicine, yeast has been used both internally and externally. Internally, it has been administered as a tonic and antiseptic in typhoid fevers. Dr. Stoker¹ states, that it usually acts as a mild laxative, improves the condition of the alvine evacuations, and is more effectual in removing petechiæ and black tongue than any other remedy. It is admissible where cinchona and wine cannot be employed, on account of the inflammatory symptoms. The dose of it is two tablespoonfuls every third hour, with an equal quantity of camphor mixture. Enemata of yeast and assafoetida are said, by the same writer, to be efficacious against typhoid tympany.

Externally, it has been used in the form of poultice. (See *Cataplasma Fermenti*.)

Yeast is an important agent in panification and brewing. In some cases of dyspepsia, unfermented bread appears to agree better with the stomach than fermented bread, which is supposed to derive an injurious quality from the yeast used in its preparation.

Yeast is sometimes added to liquids to excite the vinous fermentation, and thereby to detect the presence of saccharine matter.

L. Gmelin² employed this test to detect sugar in the animal fluids after the ingestion of amylaceous food. Dr. Christison³ found it so delicate, that he could detect with it one part of sugar in 1000 parts of healthy urine of the sp. gr. 1.030. Messrs. Richard Phillips, Graham, and George Phillips,⁴ used it to detect the presence of saccharine matter in tobacco adulterated with this substance. (For the mode of using this test, see *Saccharum*.)

1. **CATAPLASMA FERMENTI, L.**; *Cataplasma Fermenti Cerevisiæ*; *Yeast Poultice*.—(Yeast, Water heated to 100° F., of each fʒv; Flour ℥j. Mix the yeast with the water, and add the flour, stirring so that a poultice may be made. Place it before the fire until it swells up.)—It is applied, when cold, to fetid and sloughing sores as an antiseptic and stimulant: it destroys the fetor, often checks the sloughing, and assists the separation of the dead part. It should be renewed twice or thrice a day. I have frequently heard patients complain of the great pain it causes. The carbonic acid is supposed to be the active ingredient.

The following poultices are analogous in their nature and effects:—

2. **CATAPLASMA FÆCULÆ CEREVISIÆ**, Guy's Hospital Ph.; *Poultice of the grounds of beer*.—(Grounds of beer; Oatmeal; as much of each as may be required to make a poultice.)—It is applied cold twice or thrice a day, in the same cases as the preceding preparation, to which its effects are analogous.

This poultice was formerly called⁵ the *discutient cataplasma* or *cataplasma discutienti*, and was applied to disperse tumours.

3. **CATAPLASMA BYNES**, Guy's Hospital Ph.; *Malt-meal and Yeast Poultice*; *Malt Poultice*.—(Malt-meal and Beer yeast; as much of each as may be required to make a poultice.)—This poultice is to be applied warm.

¹ On Continued Fever, p. 121, Dubl. 1829-30.

² Recherches Expérimentales sur la Digestion, Paris, 1826.

³ The Library of Practical Medicine, vol. iv. art. Diabetes, p. 249.

⁴ Parliamentary Report.

⁵ Chirurgical Pharmacy, p. 279, Lond. 1761.

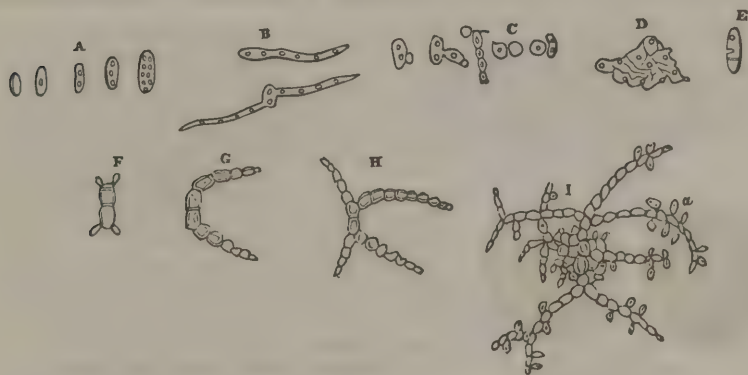
16. OIDIUM ABORTIFACIENS.—THE ERGOT-MOULD.

HISTORY.—Phillipar,¹ in 1837, recognized the joints or sporidia of this fungus on ergot. Phæbus,² in 1838, detected and figured these bodies, but did not consider them to be of a fungic nature. Mr. John Smith,³ of the Kew Garden, in November, 1838, recognized them on various ergotized grasses. He considered them to be the joints of a minute articulated fungus, from whose action ergot resulted. In December, 1838, the late Mr. E. J. Quekett⁴ gave an extended account of this fungus, in a paper read before the Linnean Society. Mr. Quekett named the plant *Ergotætia abortans* (*Ergotætia*, from *Ergot*, and *aitia*, origin; *abortans*, in allusion to its destroying the germinating power of the grain of grasses, and also to the medicinal powers of ergot). Subsequently, at my suggestion, he substituted the word *abortifaciens* for *abortans*.

Mr. Quekett at first⁵ considered this fungus to belong to the sub-order *Hyphomycetes*, tribe *Mucedines*; but after his paper had been read at the Linnean Society, and was returned to him for correction, he was led to suppose that the fungus belonged to the sub-order *Coniomycetes*, tribe *Sporidesmiei*, because its sporidia were produced beneath the epidermis of the grain. Both Link⁶ and the Rev. M. J. Berkeley consider the ergot-mould to be a mucedinous fungus belonging to the genus *Oidium* (so called from *ὄν*, an egg, and *ειδος*, resemblance), and I have, therefore, called it, at the suggestion of the last-named eminent fungologist, *Oidium abortifaciens*. Corda⁷ has recently referred it to the genus *Hymenula*, of the sub-order *Hymenophycetes*, and names it *Hymenula Clavus*.

BOTANY. Gen. Char.—Microscopic. Threads white or brightly coloured, simple or irregularly branched, moniliform above, and breaking up into more or less elliptical spores. (Berkeley in Lindl. *Med. and Econ. Bot.*, p. 14, 1844.)

Fig. 184.



Oidium (Ergotætia) abortifaciens.

A, Sporidia.

B, C, E, F, G, H, different modes of reproduction in water.

D, Membrane of sporidium laid open.

I, The fungus assuming a radiated form, and beginning to develop sporidia upon its branches in water.

¹ *Traité Organogr. et Physiologico-agric. sur l'Ergot*, Versailles, 1837.

² *Deutschl. kryptog. Gifigewächse*, Taf. ix. Berlin, 1838.

³ *Trans. Linn. Society*, vol. xviii. p. 449.

⁴ *Ibid.*, p. 453. An abridgment of this paper was published in the *Lond. Med. Gaz.* vol. xxiii. p. 606, Jan. 19, 1839.

⁵ See the *Lond. Med. Gaz.* Jan. 19, 1839.

⁶ *Report on the Progress of Physiological Botany in 1941*, published by the Ray Society, p. 91.

⁷ *Beitrag zur Kenntniss der Brandarten der Cerealien und des Mutterkorns*, in the *Ökonomische Neuigkeiten und Verhandlungen*, No. 83, 1846: a periodical publication. I am indebted to the Rev. M. J. Berkeley for the loan of Corda's paper. A copy of Corda's figures, illustrating the structure of the ergot of rye, and of the microscopic appearance of the fungus, will be given hereafter (see *Secale Cornutum*).

Sp. Char.—Threads white, irregularly branched; spores abundant, elliptic, containing two nuclei (Berkeley).

Mr. Quekett's description of the ergot-mould (called by him *Ergotretia abortifaciens*) is as follows: Sporidia elliptical, moniliform, finally separating, transparent, sometimes slightly contracted about their middle, usually containing one, two, or three, but occasionally as many as ten or twelve well-defined greenish granules. They are, on the average, about 1-4000th of an inch long, and 1-6000th of an inch broad. When placed on glass and moistened with water, they readily germinate or produce other plants, though in various ways, as sometimes by emitting tubes (B), by the development of buds (C), and by the formation of septa across their interior (E, F, G, H).

Hab.—Floral envelopes, and ovaria of grasses: Europe, America.

By the growth of these fungi upon or within the ovarium of grasses, a diseased condition of the ovarium, involving the whole of the embryo, and sometimes partially or wholly the albumen, is produced. This disease, called the *ergot* or *spur*, will be described hereafter (see *Secale Cornutum*). Mr. Quekett¹ has shown that the sporidia of this fungus are capable of infecting healthy grains of corn, and of ergotizing them.

PROPERTIES.—The chemical properties and physiological effects of this fungus are at present quite unknown. We have yet to learn whether the peculiar properties of ergotized grasses depend on the fungi, or on the morbid products of the ovarium.

Sub-order III. GASTEROMYCETES, *Endl.*

CHARACTERS—*Sporidia* free within a closed receptacle (*peridium*) collected together in the centre, or immersed and concrete, intermixed with *flocci*, or contained in proper receptacles (*sporangia*).

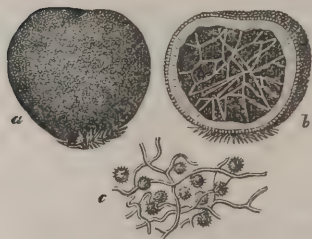
17. *Elaphomyces granulatus*, *Fries.*—Granulated *Elaphomyces*.

Lycoperdon cervinum, Linn.; *Cervi Boletus*, I. Bauh.; *Elaphomyces offirinalis*, Nees; *Tuber cervinum*, Nees; *Boletus cervinus*; *Hart's Truffles*; *Deer Balls*. Sold at Covent Garden Market, as *Lycoperdon nuts*. (*Elaphomyces*, from *ἐλαφός*, a stag; and *μύκης*, a fungus.) Rounded or oblong, from half an inch to two inches in diameter, brown, papiloso verrucose, hard. Peridium internally white. Sporidia abundant, globular, black.—Indigenous. Grows underground.

A very complete analysis has been made by Biltz². The sporidia consisted of a disagreeable odorous volatile substance, soft resin, 0.325; hard resin, 0.052; red colouring matter, uncrystallizable sugar, with fungic ozmazome, 2.708; gum, 2.083; inulin, 8.333; soluble albumen, a trace; fungin, red colouring and albuminous matter, soluble in potash; free vegetable acid, vegetable salts of ammonia, potash, and lime, sulphate and phosphate of lime, chloride of sodium, silica, manganese, and iron. The ashes amount to 1.25. The peridium deprived of its warty coat consisted of yellow rancid, soft fat, 0.33; fungic ozmazome, with crystalline sugar, 12.000; gum, 10.40; albumen, fungin, gummy and albuminous matter, soluble in potash; free vegetable acid, vegetable salts of ammonia and lime, phosphate and sulphate of lime. The ashes amount to 1.1. The warty coat contains yellow, bitter fat, colouring matter, soluble in water and alkalis, but not in alcohol or ether; bitter and other substances, but neither sugar nor inulin. The capillitium contains sugar, but no inulin.

Though still retained in some of the best modern works on medical botany published on the continent, this subterranean fungus is no longer used in medicine, at least in England. As, however, I have met with it in the stock of a London herbalist, I presume at no very long period since it must have been in use. "It was formerly used by apothecaries for the preparation of the bal-

Fig. 185.



Elaphomyces granulatus.

- a. The fruit with the mycelium (nat. size).
- b. Vertical section of ditto.
- c. Sporidia, with flocci of the capillitium (magnified).

¹ *Lond. Med. Gaz.* Oct. 8, 1841; and *Trans. of the Linn. Society*, vol. xix. p. 137.

² *Frommsdorff's Neues Journ. d. Pharm.* Bd. xi.

samus apoplecticus; and great power was ascribed to it in promoting parturition and the secretion of milk. Even now the country people in some places esteem it as an aphrodisiac, and prepare from it a spirituous tincture.¹ Parkinson² says the dose of it is one drachm and a half in powder, taken with sweet wine, or with such other things as provoke venery.

18. *Lycoperdon giganteum*, Batsch.—Giant Puffball.

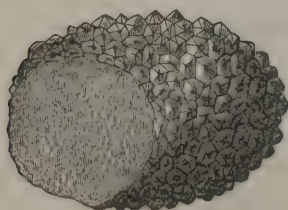
LYCOPERDON BOVISTA (GIGANTEUM), Fries; *Bovista gigantea*, Nees.—Sold in the London herb shops as the *Common Puffball*, or simply as *Puffball*.—They are the *Fusseballs* of Parkinson.—In somewhat globular or obconical masses of variable size, sometimes one or two feet in diameter, and usually of a more or less yellow colour. *Peridium* very brittle, bursting in areolæ, evanescent, at length broadly open. *Capillitium* rare, evanescent together with the olive dingy-brown *sporidia*. This species, as well as *Lycoperdon calatum* of Bulliard, has been used in medicine under the name of *bovista*, *fungus chirurgorum*, and *crepitus lupi*. The spongy capillitium with the sporidia has been employed for staunching blood: thus it has been used as a plug in epistaxis, hemorrhage from the teeth, rectum, &c. The spongy base is employed as tinder. The fumes of this fungus, when burnt, are said to possess a narcotic quality, and have been employed to stupefy bees.

19. *Tuber cibarium*, Sibth.—Common Truffle.

LYCOPERDON TUBER, Linn.; *Tubera*, Tournef.; *Tubera sincera*, Pliny, lib. xix. cap. 11. Dr. Sibthorp (*Floræ Gr. Prodr.* ii. 352) considers it to be the *ῥύζον* of Diosc. lib. ii. cap. 175: its modern Greek name being *ῥύζον ἢ ἱανός*: but Fries, while he admits, on the authority of Sprengel, that it is the *ῥύζον* of Theophrastus (*Hist. Pl.* lib. i. cap. 9), says it is certainly not the *ῥύζον* of Dioscorides.³

The truffle of the markets occurs in rough, rounded nodules, varying in size from a filbert to the fist, cracked into small subpyramidal warts. Internally, it is marbled or veined. The white portions are filamentous, and are regarded by the Rev. M. J. Berkeley as constituting a sort of mycelium to the darker portions, which he calls the veins: the latter are cellular, and contain many subovate, shortly pedicellated *sporangia*, at first filled with a granular mass, which is ultimately collected into one or two globular, yellowish echinulate *sporidia*.

Fig. 186.



A truffle (natural size) from which a slice has been cut to expose the internal structure.



Tuber cibarium.

A section of a truffle (magnified).

a a. Cells.

b b c. Pedicellated peridiola or sporangia containing sporidia.

d. A sporidium (or spore) more highly magnified.

In France, three varieties of truffle are known:⁴ the *truffle de Perigord* with black flesh; the *truffle de Bourgogne* with white flesh; and a third sort with violet flesh. The first is the most esteemed, on account of its odour and tenderness.

This fungus grows several inches below the surface of the ground in several parts of England. Covent Garden market is chiefly supplied from the downs of Wiltshire, Hampshire, and Kent. Its odour is peculiar and penetrating, by which its presence is detected. In this country it is usually hunted by dogs trained for the purpose: in Italy, by pigs.

Riège⁵ analyzed the dried Perigord truffles, and found them to consist of a *brown fat oil* (olein) with traces of *volatile oil*, an *aeric resin*, *osmazome*, *mushroom sugar*, *nitrogenous matter* insoluble

¹ Gleditsch, quoted by Nees v. Esenbeck and Ebermaier, *Handb. d. med. pharm. Botanik*, Bd. i. S. 28, 1832.

² *Theatrum Botanicum*, p. 1320, 1640.

³ *Systema Mycologicum*, vol. ii. p. 290, 1822.

⁴ Méral and De Lens, *Dict. Univ. de Mat. Méd.* t. vi. 783.

⁵ *Pharmaceutisches Central-Blatt für 1844*, p. 17; also, *Chem. Gaz.* vol. ii. p. 137.

in alcohol, *fungic acid*, *boletic acid*, *phosphoric acid*, *potash*, *ammonia*, *vegetable mucus*, *vegetable albumen*, *pectine*, and *fungine* (fungic skeleton).

Truffles are a highly esteemed luxury at the table, being used as a seasoning or flavoring ingredient for ragouts, sauces, stuffings, &c. They are considered to possess aphrodisiac properties; and an Italian physician essayed to prove that births were more numerous in those years which correspond to the more abundant production of truffles!

Sub-order IV. PYRENOAMYCETES.

CHARACTERS.—*Perithecium* indurated, at first closed up, then perforated by a pore or irregular laceration, inclosing a softer nucleus. *Sporidia* immersed in mucus, or inclosed in *asci*, which are attached by their base.

20. *Sphæria Sinensis*, Berk.

Hia Tsao Tom Tchom, Reaumur, Mém. de l'Acad. des Sc. 1726, p. 302, tab 16; *Hia Tsao Tong Tchong*, Du Halde, Descr. Géogr. et Hist. de la Chine, vol. iii. p. 490, 1770; *Totsu Kasa*, Thunberg, Travels in Europe, Asia, &c. between 1770 and 1779, vol. iii. p. 68; *Hiastaotomtchom*, Rees's Cyclop.; *Tong Chong Ha Cho*, Reeves; *Summer-Plant-Winter Worm*, Pereira, Pharm. Journ. vol. ii. p. 590, 1843; *Hea Tsaou Taong Chung*, Westwood, Ann. of Nat. Hist. vol. viii. p. 217; *Sphæria Sinensis*, Rev. M. J. Berkeley, in Hooker's Lond. Journ. of Botany, vol. ii. p. 207, 1843.

This remarkable production is a highly esteemed article of the Chinese Materia Medica. It consists of a caterpillar or larva of a lepidopterous insect (probably a species of *Agrotis*), from whose neck projects the fungus, called by the Rev. M. J. Berkeley, *Sphæria Sinensis*.

SPHÆRIA, Fries. *Perithecium* rounded entire, furnished at the apex with a minute orifice. *Asci* converging, at length dissolving.

S Sinensis, Berkeley. Brown; stem cylindrical, somewhat thicker downwards; head cylindrical, confluent with the stem, pointleted.

Fig. 187.



Fig. 188.



Sphæria Sinensis.

Fig. 187, Isolated individual.

Fig. 188, Bundle.

(Natural size.)

Du Halde says that it is produced in Thibet, and also on the frontiers of the province of Setchuen, which borders on Thibet, or Laza. It is brought to Canton in bundles tied up in silk (see Fig. 188): each bundle containing about one dozen individuals.

Each individual (see Fig. 187) is about three inches long, half being the caterpillar; the other half projecting from the back of the neck is the club shaped fungus, attached by slender filaments, which spread over the surface of the larva. The substance of the caterpillar is replaced by a mass of fine branched threads, mixed with globules of oil. In none of the specimens examined by Mr. Berkeley were the perithecia developed.

In China, it is reputed as a strengthening and renovating substance, and is supposed to possess properties similar to those ascribed to ginseng. It is recommended in cases where the powers of the system have been reduced by over-exertion or sickness. But on account of its scarcity it is only used in the palace of the Emperor.

The mode of employing it is curious. The belly of a duck is to be stuffed with five drachms of this fungus, and the animal roasted by a slow fire. The virtue of the fungus is supposed to pass into the flesh of the animal, which is to be eaten twice daily for eight or ten days!

Sub-order V. HYMENOMYCETES.

CHARACTERS.—Spores generally quaternate on distinct *sporophores* (*basidia*). *Hymenium*, naked.

21. *Exidia Auricula Judæ*, Fries.—Jew's Ear.

Tremella Auricula Judæ, Linn.; *Peziza Auricula*, Linn. This fungus grows on living trees, especially the elder; whence its name *fungus sambuci*, vel *sambucinus*. It is still professed to be kept in the London herb-shops; but in its place, I find that *Polyporus versicolor*, Fries, is usually sold for it. Dr. Martiny¹ states that other species—namely, *Polyporus adustus*, Fries, *Polyporus zonatus*, Fries (especially when this is strongly dried and half charred), and *Dædalea unicolor*, Fries, are substituted for the genuine plant. All these adulterations or substitutions may be readily detected by immersing the dried fungus in water: the genuine *Exidia Auricula Judæ* softens and swells up so as to resume its natural gelatinous condition, whereas the others do not soften in water. It was formerly in repute as a topical astringent and discutient; and was employed in the form of decoction or infusion (made with water, rose-water, vinegar, or milk), and cataplasm made with milk and water. It has been used in sore-throat, sore-eyes, and deafness.² On account of its absorbing and retaining liquids, it has been soaked in collyria and applied to the eyes, as a substitute for sponge.

22. *Morchella esculenta*, Linn.—Common Morell.

Phallus esculentus, Linn; *Helvella esculenta*, Sowerby; *Fungus faginosus*, Lobel., Gerarde, Parkinson; *Merulius*, J. Bauh. Hist. Pl.

This fungus is sold at the Italian warehouses, and at Covent Garden Market, in the dried and shrivelled state; and though a native of this country, is usually imported from the Continent. In the fresh state it is from 2 to 5 inches high, and hollow (see Fig. 159). The stem is white, from 1 to 3 inches long, $\frac{1}{2}$ to 1 inch in diameter. The *pileus*, which is confluent with the stem, varies in size from that of a pigeon's egg to that of a swan's egg; is deeply pitted or formed in irregular areolæ, divided by anastomosing ribs, and varies in colour from a pale yellowish brown to olivaceous and smoke gray. The *hymenium* covers the whole *pileus*. The *thece* usually contain five globular spores.

The Morell is a highly-esteemed luxury at table. It usually enters into ragouts or other dishes; but is sometimes cooked by itself, being either stewed, or stuffed and dressed between thin slices of bacon. Though considered to possess nutritive qualities, it is employed at the table as a flavouring ingredient. Virey³ enumerates it among aphrodisiacs.

23. *Polyporus officinalis*, Fries.—Larch Agaric.

SYNONYMES.—*Boletus Laricis*, Jacq., Misc. ii. p. 164; Ph. Boruss. *Boletus purgans*, Pers. Syn. p. 531. *Boletus officinalis*, Villars Delph. p. 1041. *Polyporus Laricis*, Roques.

HISTORY.—This fungus was used by the ancients. It is described by Dioscorides⁴ under the name of Ἀγαρίκον. In the modern Greek Pharmacopœia, it is termed Ἀγαρίκον τὸ λευκόν, its Turkish name being Κατὰν μανταρί.

BOTANY. **Gen. Char.**—*Hymenium* concrete, with the substance of the *pileus*, consisting of subrotund pores with their simple dissepiments. (*Berkeley*.)

Sp. Char.—*Pileus* corky-fleshy, ungulate, zoned, smooth. Pores yellowish (*Fries*).

Hab.—South of Europe and Asia, on the Larch.

COMMERCE.—The best agaric is brought from Asia and Carinthia. A small and inferior kind is collected in Dauphinè. I was informed by the late Mr. Butler, of Covent Garden Market, that the London shops were supplied from Germany.

¹ Encyklop. d. Naturalien u. Rohrwarenk, Bd. i. S. 911, 1843.

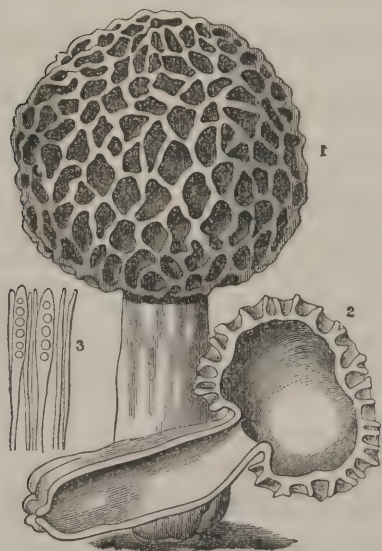
² For further details respecting it, consult Alston's *Lect. on the Mat. Medica*, vol. i. p. 351, 1770; and Murray. *App. Medicaminum*, vol. v. p. 583.

³ *Bull. de Pharm.* t. v. p. 201, 1813.

⁴ Lib. iii. cap. 1.

Levant Agaric (an inferior sort of which is known at Marseilles by the name of *cucumule*) is exported from Smyrna. The Russian larch agaric, exported from Archangel, is the product of *Larix sibirica*.¹

Fig. 189.

*Morchella esculenta*.

1. *Morchella esculenta* (nat. size).
2. A section of ditto.
3. Thecae and spores magnified.

Fig. 190.

*Polyporus officinalis*.

(Represented as growing on the stem of a tree.)

COLLECTION.—It is collected in the months of August and September, decorticated, dried, and bleached in the sun. Martiny states that it is beaten with wooden hammers to make it soft. But that which I have found in English commerce has neither been decorticated nor beaten.

DESCRIPTION.—This fungus is still kept in the herb-shops, being sold under the name of *agaric*, *white agaric* (*agaricus albus*), or *larch* or *female agaric* (*fungus laricis*). It occurs in masses, varying in size from that of the fist to that of a child's head. The most usual shape which I have found is that of a horse's hoof, or of half a cone (divided by a plane passing through both the apex and the base).² Externally, it is yellowish or reddish gray; internally, it is white. It has a very feeble odour, and a bitter acrid taste. It is liable to be attacked by a beetle, the *Anobium festivum*, Panz.

COMPOSITION.—It has been analyzed by Bouillon-La-Grange;³ by Bucholz;⁴ by Braconnot,⁵ and by Bley.⁶

The constituents, according to Bley, are resin, 33.1; extractive, 2; gum and bitter extractive, 8.3; vegetable albumen, 0.7; wax, 0.2; fungic acids, 0.13; boletic acid, 0.06; tartaric and phosphoric acids, 1.354; potash, 0.329; lime, 0.16; ammonia and sulphur, traces. The following substances were obtained by the action of caustic potash and hydrochloric acid: coagulated albumen, 0.4; artificial gum, 15.5;

¹ Martius, in Buchner's *Repertorium*, N. S. Bd. xli. S. 92, 1846.

² The specimen from which Fig. 190 was taken was kindly lent me by the Rev. M. J. Berkeley. I have had it represented as growing on the stem of a tree.

³ *Ann. de Chimie*, t. li. p. 76, 1808; also, Thomson's *Chemistry of Organic Bodies—Vegetables*, p. 939, 1838.

⁴ Berlin, *Jahrbuch für* 1808, p. 111.

⁵ *Bull. de Pharm.* t. iv. p. 304, 1812.

⁶ Trommsdorff's *N. Journ.* Bd. xxv. S. 119, 1832; Martiny, *Encyklop. d. Natur.* S. 909.

artificial resin, soluble in ether, 9.5; residual *fibre* called *fungine* (cellulose), 15; *moisture*, 11, and *loss*, 2.367 = 100.000.

The active principle of agaric has been usually said to reside in the resin; but Martius¹ states that it is a peculiar substance, which he proposes to call *laricin*. This is a white amorphous powder, possessing a bitter taste, soluble in alcohol and oil of turpentine, and forming with boiling water a paste. It has been analyzed by Dr. Will, who found that its formula was $C^{14}H^{12}O^4$.

The *resin* of agaric possesses purgative qualities, and was formerly employed for the adulteration of jalap resin.² It probably contains laricin.

EFFECTS.—Larch agaric is an acrid substance. Its dust irritates the eyes, and causes sneezing, cough, and nausea. When swallowed in the dose of a drachm or two, this fungus excites nausea, vomiting, griping, and purging, and is said to check sweating.

USES.—It has been employed internally as an emetic, cathartic, discutient, and to check colliquative sweating; externally, as an astringent. De Haen reported favourably of it as an anti-sudorific in phthisis, and Barbut confirms his statements. Favourable reports of it were also made by Toel, Neumann, Kopp, Burdach, Andral, and others. Subsequently, however, Andral has expressed an opinion that little benefit is to be derived from it.

ADMINISTRATION.—The dose of it is from ʒss to ʒj as a purgative; and from grs. iij to grs. viij, taken before going to sleep, to check sweating.³

24. Polyporus igniarius, Fries.—Hard Amadou Polyporus.

Boletus igniarius, Linn.—An indigenous fungus found on willow, cherry, plum, and other trees, and commonly known by the names of *Agaric of the Oak* (*Agaricus* seu *Fungus Quercus*; *Agaricus Quermus*), or *Surgeon's Agaric* (*Agaricus Chirurgorum*); *Spunk*; *Touchwood*. Formerly used in surgery as a mechanical styptic, and still retained in some foreign pharmacopœias (e.g. *Pharm. Castrensis Ruthenica*, 1840). It is prepared by decorticating it, cutting it into thin slices, and beating it with a mallet until it has become sufficiently soft. Its action in restraining hemorrhages is mechanical, like lint.⁴ In some places, both it and the following species are employed in the preparation of Amadou or tinder.

25. Polyporus fomentarius, Fries.—Real Amadou.

Boletus fomentarius, Linn.—Another indigenous fungus, found on the oak, birch, and other trees. Its uses are similar to the preceding, and it might, with more propriety, be called *Agaric of the Oak*, or *Surgeon's Agaric*. The substance sold in the shops as *Amadou*, or *German tinder*, is prepared from this, as well as the preceding species, by cutting the fungus in slices, beating it, and then soaking it in a solution of nitre, and afterwards drying it. When impregnated with gunpowder it is called *black amadou*. Amadou, or German tinder, has been recommended by Mr. Wetherfield⁵ as an elastic medium for applying support and pressure, and as a defence to tender and delicate parts; as in the form of a graduated compress, in umbilical hernia of newborn infants, and as a compress over fistulous ulcers of the groin. It does not lose its elasticity, like lint.

26. Agaricus campestris, Linn.—Mushroom.

Agaricus edulis, Roques.—Fries⁶ considers this species to be the *μύκης ἐδάδιμος* of Dioscorides (lib. i. cap. 109); the *Fungi qui rubent callo* of Pliny (*Hist. Nat.* lib. xxii. cap. 47). *Μανιτάρι hodiè* Gr. Sibth.

AGARICUS, Linn. *Hymenium* consisting of plates radiating from a common centre, with shorter ones in the interstices, composed of a double closely connected membrane, more or less distinct from the pileus. *Veil* various or absent.—Named from *Agaria*, a region of Sarmatia (*Berkeley*).

¹ Buchner's *Repertorium*, Bd. xli. S. 93, 1846.

² Jacquin. *Diss. de Agarico Offic.*, Vind. 1778 (Richter's *Arzneimittellehre*, Bd. ii. S. 275).

³ For further details respecting its medical uses, see Murray, *App. Med.* vol. v. p. 573; Riecke, *die neuern Arzneimitt.*; and Dauglison, *New Remedies*; and, for formulæ for its preparation, see Jourdan's *Pharmacopée Universelle*.

⁴ *Phil. Trans.* vols. xlviii. and xlix.; Warner's *Cases in Surgery*, p. 338; Murray, *App. Medicam.* vol. v.

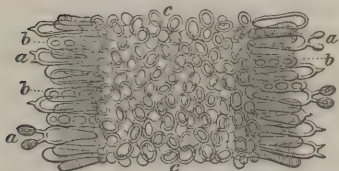
⁵ *Lond. Med. Gaz.* Nov. 26, 1841, p. 337.

Systema Mycologicum, vol. i. p. 281, 1821.

A. campestris, Linn.; pileus fleshy, dry, subsquamose or silky, gills pink free ventricose, at length brown, stem stuffed, furnished with a ring white (*Berkeley*).

Pileus or caps 2-5 inches broad, at first convex, then plano-convex, white or light brown, silky or clothed with reddish brown adpressed fibrillæ collected into little fascicles; epidermis easily peeled off, projecting beyond the gills, and often curled back, fleshy; flesh firm, thick, white, more or less stained with reddish brown, especially when bruised. Gills very unequal, at first of a beautiful pink, free, obtuse, and sometimes forked behind, broad in the middle; at length dark, mottled with brownish purple; the edge white, and minutely denticulate. Spores minute, elliptical, purplish brown immediately supported on spicules (*sterigmata*) which surmount the sporophores (*basidia*). Root consisting of branched fibres (*mycelia*). When quite young, there is a fine silky universal veil (*Berkeley*, with additions).

Fig. 191.



Section of one of the gills of A. campestris.

a a a. Sporophores surmounted by spicules bearing spores. Link¹ terms these bodies small tubes with stalked granules (*antheridia*).

b b b. Small tubes with transverse septa. According to Link they become spores.

c c c. The central vesicular tissue.

fibres (*mycelia*), which form the so-called root of the mushroom, and upon which, at short intervals, are many very small round buds (the infant state of the plant). This spawn is collected and saved by gardeners, and at the commencement of autumn is planted on beds of dung, and covered with straw: in about two months the mushrooms come up, and rapidly increase. Mixed with dung, and made up into rectangular cakes, it forms what are called *spawn cakes* or *spawn-bricks*. These are sold at Covent Garden Market, and are planted in beds.

Mushrooms are also propagated without spawn. The principal ingredient employed in preparing the compost used for this purpose is horse-droppings.² "The artificial production of this species without the aid of spawn," says the Rev. M. J. Berkeley,³ "has been frequently brought

Fig. 192.

A. *Agaricus campestris*.

a Button.

b. Ditto; the annulus splitting from pileus.

B. *A. campestris* (flap or full grown Mushroom).C. *A. Georgii*.

¹ *Icones Selectæ Anatomico-Botanica*, Fasc. iii. Berlin, 1841.

² See Loudon's *Encyclopædia of Gardening*.

³ *English Flora*, vol. v. part ii. p. 107.

forward as an argument for the equivocal generation of fungi. But when it is considered how many millions of these sporules must be devoured together with the herbage by the animal, whose dung is a principal material in the compost, much of the force of this argument vanishes."

The young mushroom is gathered while the margin of the pileus is connected with the stalk by the veil, and at this period it is commonly called the *button mushroom* (Fig. 192, A a). The mature mushrooms are collected and sold as *full grown* or *flap mushrooms* (Fig. 192, B). Dr. Badham¹ mentions a very large variety commonly called by peasants the *ox-mushroom*.

The mushroom was analyzed by Vauquelin,² who found in it a *brown-red fat*, a *spermaceti-like fat*, *mushroom sugar*, *peculiar animal matter*, *ozmazome*, *albumen*, *fungine* [cellulose], *acetate of potash*, and *other salts*.

This species is esculent, and in general wholesome; but it is employed at table for its savory, rather than for its nutritive qualities. At times it proves indigestible and unwholesome; occasionally, perhaps, from some peculiarity in the quality of the mushroom, or from the mode of cooking it; but frequently from idiosyncrasy on the part of the sufferer. The particular circumstances, however, which render it unwholesome, are very obscure. Its use should be avoided by dyspeptics, by persons liable to pruriginous, exanthematous, and scaly diseases of the skin, and by those who have a highly susceptible nervous system.

The juice of the mushroom, flavoured with salt and aromatics, constitutes the sauce called *ketchup* (a word said to be derived from the Japanese *kit-jap*), which, though in common use at table, rarely produces any unpleasant effects when used in small quantities.

AGARICUS GEORGII, Withering.—This species, called *St. George's Mushroom*, because it grows up about St. George's day (April 23d), is said by the Rev. Mr. Berkeley to be frequently sold in London under the name of *White Caps*. But I have inquired for it by this name among the dealers in Covent Garden Market, but cannot meet with any one acquainted with it (Fig. 192, C).

It is larger than the common mushroom (*A. campestris*), which it resembles in shape. When bruised it soon turns yellow, and by this character may be readily distinguished from the common mushroom, which turns pink when cut. Its smell is strong and unpleasant. It contains but little juice, and that of a yellow colour, and is, therefore, not adapted for making ketchup.

Though not poisonous, it is less wholesome than the preceding species, and is usually rejected by housekeepers. It is very tough, and difficult of digestion.

27. *Agaricus oreades*, Bolton.—Champignon.

Agaricus oreades, Withering, Brit. Pl., vol. iv.; *A. pratensis*, J. Sowerby, Eng. Fungi; J. Sowerby, Jun. The Mushroom and Champignon illustrated; *A. Pseudo-Mousseron*, Bulliard; *Fairy Ring Agaric*; *Scotch Bonnets*.—This indigenous plant occurs in pastures, and is one of several fungi which grow in circles forming what have been termed *Fairy-rings*. It is commonly sold in the shops for use at table, and is liable to be mistaken for several other species of *Agaricus*, viz.: *A. dealbatus*, *dryophilus*, *semiglobatus*, and *fæniseei*. Of these, *A. dealbatus* is the only one which, like the true champignon, forms "fairy-rings."

Fig. 193.



Agarici.³

a b. *A. oreades*.
c d e. *A. dealbatus*.

f g h. *A. dryophilus*.
i k. *A. semiglobatus*.

l m. *A. fæniseei*.

¹ *Treatise on Esculent Funguses*, p. 85, 1847.

² *Ann. de Chimie*, lxxxv. 5, 1813.

³ In the above cut, the figures marked a and b are from Mr. J. Sowerby, Jr.'s "*Mushroom and Champignon Illustrated*;" the others, from Mrs. Hussey's *Illustrations of British Mycology*, part xiii. pl. xxxix. 1848.

The fungus varies in colour from a pale to a deep buff or nankeen colour. The stem is 1 or 2 inches high, and 2 or 3 lines thick, round, solid, often slightly twisted, readily splitting longitudinally into silky fibres, and is of the same colour as the gills. The pileus or cap is from $\frac{1}{2}$ to 1 inch in diameter, irregularly round, convex, most elevated in the centre, tough and coriaceous. The gills free, distant, waved at the edges, often lacerated, paler than the pileus. "If the pileus be cut through (Fig 193, b) the gills will not be found to separate from it, but the fleshy part runs down the middle of each gill, which is covered by the continuation of the same buff-coloured coat that lines the under surface of the pileus between the gills—a structure widely different from the poisonous one [*Ag. semi globatus*]."¹ Taste and odour agreeable.

A. DEALBATUS, Sowerby (Fig. 193, c d e) is distinguished from the champignon by the margin of the pileus being at first rolled inwards, by its very fine dingy whitish gills, by its becoming gray-brown in zones when soaked in water, and by its disagreeable odour. This species, according to Mrs. Hussey, resembles the champignon more than any other; and like it also grows in fairy-rings.

A. SEMI-GLOBATUS, Batsch. (Fig. 193, i k); the *A. virosus* of Sowerby is distinguished from the champignon by its dark-coloured gills, its hollow stem, and shining glutinous pileus. When young, this species has an annulus or ring, but this commonly disappears when the plant has attained its full size.

A. FÆNISECII, Persoon (Fig. 193, l m), is distinguished from the champignon by its dark-coloured gills, its hollow stem, and its umber-purple spores.

A. DRYOPHILUS, Bulliard (Fig. 193, f g h), is distinguished from the champignon by its fine close gills, its hollow stem, and its reddened swollen base.

Like the *Agaricus campestris*, or mushroom, the *A. oreades*, or Champignon, is used at table on account of its savory qualities, and not for its nutritive power, which is probably very slight.

28. Fungi venenati.—Poisonous Fungi; Toadstools.

Many fungi are poisonous, and a still larger number frequently prove indigestible and unwholesome. The same species which may be taken with impunity by one individual will excite in another various inconveniences, such as nausea, vomiting, griping, diarrhœa, &c. Dyspepsia, and a highly susceptible condition of the nervous system, such as that called the hysterical constitution, dispose to those ill effects, which, in other cases, are ascribed to idiosyncrasy of constitution.

It must be obvious from these remarks that there can be no absolute anatomical characters by which the unwholesome can be distinguished from the wholesome species; the effects greatly depending on the constitution of the eater, or on some other insufficiently determined circumstances. An illustrative fact of the truth of this statement has been adduced in the case of a French officer and his wife, who died in consequence of breakfasting off some poisonous

Agarics, which were nevertheless eaten by other persons in the house with impunity. These, and other circumstances, have led to a general distrust of all fungi, except the cultivated ones; and so strongly was the late accomplished botanist, Professor L. C. Richard, impressed with this feeling, that, though no one was better acquainted with the distinctions of Fungi than he was, yet he would never eat any except such as had been raised in gardens in mushroom beds.

Of the genus *Agaricus*, all those species which belong to the subgenus *Amanita* are either actually poisonous or highly suspicious. The characters of this subgenus are thus laid down by the Rev. M. J. Berkeley :—

AMANITA (a name given to some esculent Fungus by Galen). Veil double: one universal, covering the whole plant in a young state, distinct from the epidermis, at length burst by the protrusion of the pileus, part remaining at the base of the stem, part either falling off, or forming warts on the pileus; the other partial, at first covering the gills, and afterwards forming a reflected subpersistent ring on the top of the stipes. Stem puffed, at length hollow, squamoso fibrillose, thickened at the base. Pileus with the disk fleshy, the margin thin, campanulate, then plane; viscid, when saturated with moisture. Gills attenuated behind, free, broader in front, ventricose, close, but little unequal; when full-grown, denticulated.

One of the most remarkable species of this subgenus is the *AGARICUS MUSCARIUS*, Linn. (*Amanita muscaria*, Greville), the remarkable effects and uses of which have been already noticed (see *ante*, vol. i. p. 152).

Fig. 194.



Agaricus muscarius.

¹ Sowerby, Jr., *The Mushroom and Champignon Illustrated*.

The Russians, who eat no less than sixteen species of agaricus,¹ never employ any belonging to the subgenus *Amanita*.²

Besides the species of the subgenus *Amanita*, many other Agarici are poisonous or suspicious.

The symptoms produced by poisonous fungi are those indicating gastro-intestinal irritation (nausea, vomiting, purging and abdominal pain), and a disordered condition of the nervous system (delirium, stupor, blindness, convulsions, muscular debility, paralysis, and drowsiness). In some cases, the power of the vascular system is remarkably depressed, the pulse being small and feeble, the extremities cold, and the body covered with a cold sweat. At one time, local irritation only; at another, narcotism alone is produced.³

In some cases the active principle of poisonous fungi seems to be a *volatile acrid principle*; in other instances it is a brown, uncrystallizable solid, called by Letellier *amanitin*.

No specific antidote is known. The first object, therefore, is to expel the poison from the stomach and bowels. The subsequent treatment will depend on the nature of the symptoms which manifest themselves, and must be conducted on general principles.⁴

Class II. Acrogenæ, Ad. Brogniart.—Acrogens

PSEUDOCOTYLEDONEÆ, Agardh; HETERONEMEÆ, Fries; ACROBRYA, Mohl, Endlicher.

CHARACTERS.—*Substance of the plant* composed of cellular tissue chiefly, and, in the higher forms, of vessels. *Cuticle* bearing stornata or breathing pores. *Stem and leaves* distinguishable. *Opposition of stem and root*. Stem growing at the point only

This class includes a number of Orders, of which two only (viz. *Lycopodiaceæ* and *Filices*) need be here noticed as yielding anything useful in medicine.

ORDER IV. FILICES, Juss.—FERNS.

FILICALES, Lindley.

CHARACTER.—Herbaceous plants with a perennial rhizome, more rarely having an erect arborescent trunk [when they are called tree ferns, *filices arboreæ*; Fig. 195]; trunk coated, of a prosenchymatous structure, with the entire cylinder of woody fasciculi divided into two concentric parts, the one narrow, placed between the bark and the wood; the other larger, central, medullary, sending fasciculi of vessels towards the petioles, and communicating with the exterior by means of chinks in the woody cylinder. *Leaves* [*frondes*] scattered upon the rhizome or rosaceo-fasciculate on the apex of the caudex, with circinate vernation, annual or perennial, the base of the petioles persistent, growing to the caudex; simple or pinnate, entire or pinnatifid, [equal-] veined (the veins composed of elongated cells), frequently having cuticular stomata. *Sporangia* [*thecæ*], placed on the veins of the back or margin of the leaves, collected in little naked heaps [*sori*], or covered with a membranous scale [*indusium*], or transmutated margin of the leaf, pedicellate [with the stalk (*seta*), passing round them in the form of an elastic ring (*annulus*)], or sessile, unilocular, indefinitely deliscent. *Spores* [*sporules*] numerous, free, globose, or angular, in germination at first

Fig. 195.



Cyathea glauca (a tree fern).

¹ For some remarks on the Fungi used as food by the Russians, see Lyall's *Character of the Russians*, and a detached *History of Moscow*, p. 556, Lond. 1823.

² Dr. Lefevre, *Lond. Med. Gaz.* xxiii. 414.

³ For illustrations of the effects of particular species, consult Phæbus, *Deutschl. kryptog. Giftgewächse*, 1838; and Letellier, *Journ. de Pharm.* Août. 1837.

⁴ For further information respecting poisonous fungi, consult Christison's *Treatise on Poisons*.

elongated in every direction, throwing out radicles downwards, and the cauliculus upward (*Endlicher*).

PROPERTIES.—The leaves are mucilaginous, and frequently slightly astringent and aromatic. The rhizomes contain *starch*, *saccharine matter* and *gum*, usually *tannic* and *gallic acids*, with more or less *bitter matter*, and sometimes both *fixed* and *volatile oils*, *resin*. They are considered to possess astringent and tonic properties, and in some cases act as vermifuges.

From the tuberous rhizomes of fern is obtained, in some of the Polynesian islands, as well as in some other parts of the world, a farinaceous or ligneous matter, which is employed by the natives as a nutritive substance. The rhizomes are cooked by baking or roasting. In general, however, they are only resorted to in times of scarcity, when other and more palatable food cannot be obtained.¹

Several ferns have been used in medicine. Those which I shall particularly notice are *Nephrodium Filix mas*, still retained in the British pharmacopœias, and used as a vermifuge, and *Adiantum* or *Maidenhair*, a syrup of which, or a substitute for it, is still found in the shops under the name of *capillaire*.

Ruiz² has written a memoir on three fern roots sent from Peru, in South America, to Spain, under the name of *Calaguala* (more correctly *Ccallahuala*, from *callua*, a batten or trowel, and *hualas*, a boy, i. e. a boy's batten). The first, or the genuine *Calaguala*, or *Ccallahuala*, or slender *Calaguala*, is the rhizome of *Polypodium Calaguala*, Ruiz; the second, called thick *Calaguala*, *Puntu-puntu*, and sometimes *Deer's tongue* (*Lengua de Ciervo*), is the rhizome of *Polypodium crassifolium*, Linn.; and the third, termed middling *Calaguala*, the little cord (*Cor-doncillo*), or *Huacsaro*, is the rhizome of *Aerostichum Huacsaro*, Ruiz. The first is the species which should be used in medicine: as, however, it is unknown in English commerce. I need not describe it. Professor Guibourt³ has figured three sorts of the rhizome, but states that, judging from Ruiz's description, he has not seen the true *Calaguala*. He once found the *Mallesse fungus* (*Cynomorium coccineum*) in some *Calaguala* which he received from Marseilles. *Calaguala* has been analyzed by Vauquelin⁴. This rhizome is regarded in Peru as possessing deobstruent, sudorific, diuretic, anti-venereal, and febrifuge virtues; and it is frequently used to thin the blood, to promote perspiration, and to mitigate rheumatic and venereal pains. It is commonly administered in the form of decoction, prepared by boiling one ounce of the fresh root in six pints of water to three pints. This decoction is taken *ad libitum* as a kind of diet drink.

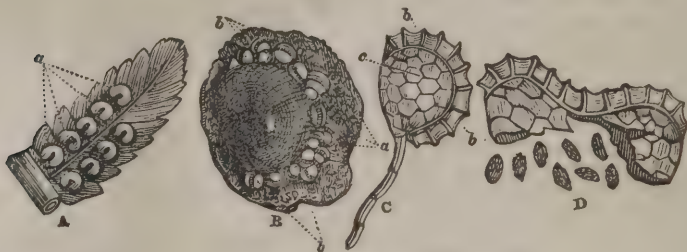
29. NEPHRODIUM FILIX MAS, Richard.—MALE SHIELD FERN.

Sex. Syst. Cryptogamia, Filices.
(Rhizoma.)

SYNONYMES.—*Polypodium Filix mas*, Linn.; *Aspidium Filix mas*, Swartz.

HISTORY.—Fern-root was employed by the ancients in medicine. Theophrastus⁵

Fig. 196.



Nephrodium Filix mas.

- A. Pinnule with nine sori (a).
B. Magnified portion of pinnule with the sporangia. a. Stomata. b b. Sporangia partially covered by c. the indusium.

- C. Magnified sporangium. a. Stalk. b. Ring.
c. Membranous sac.
D. Ruptured sporangium, with the spores escaping.

¹ Ellis, *Polynesian Researches*, vol. i. p. 363; Bennet, *Narrative of a Whaling Voyage*, vol. ii. p. 394. 1840.—Dieffenbach (*Travels in New Zealand*, vol. ii. 1843) says that the "*korau* or *mamako*, the pulposus stem of a tree-fern (*Cyathea medullaris*) is an excellent vegetable;" and, he adds, "it is prepared by being cooked a whole night in a native oven."

² *Memoria sobre la legitima Calaguala y otras dos raices que con el mismo nombre nos vienen de la America Meridional*, Madrid, 1805. A translation of Ruiz's Memoir is contained in Lambert's *Illustration of the Genus Cinchona*, p. 98, 1821.

³ *Hist. Nat. des Drogues simpl.* t. ii. p. 87, 4me. ed. 1849.

⁴ *Hist. Plant.* lib. ix. cap. xx. and xxii.

⁵ *Ann. Chimie*, t. lv. p. 22.

notices two kinds of fern; the male, which he calls *πτέρις*, and the female, termed *θηλυπτερίς*. Dioscorides¹ also mentions these two ferns, and states that the *πτέρις* is by some persons called *βλήκνον*, by others *πολύρριζον*. Pliny² notices both ferns, and says the *pteris* is supposed to be the male fern (*filix mas*).

BOTANY. Gen. Char.—*Sori* roundish, scattered. *Inclusium* orbicularreniform, fixed by the sinus.

Sp. Char.—*Fronde* bipinnate, pinnules oblong, obtuse serrated, their stalk and midrib chaffy. *Sori* near the central nerve (*Hooker*).

The rhizome is large, tufted, and scaly. The leaves grow in a circle to a height of 3 or 4 feet.

Hab.—It is an indigenous plant, frequent in woods and in shady banks. It is a native of other parts of Europe, of Asia, of the North of Africa, and of the United States of America.

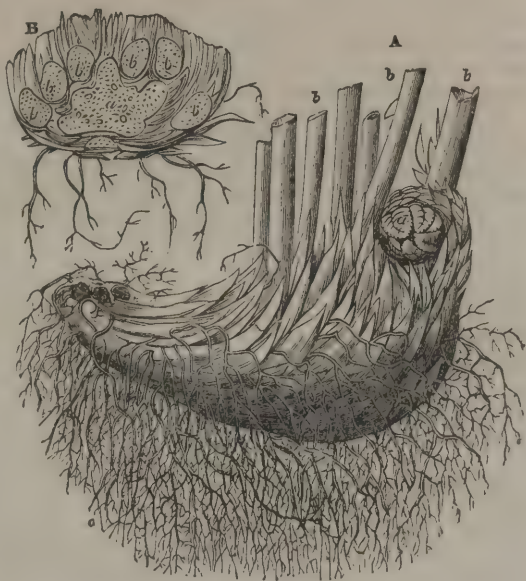
DESCRIPTION.—The subterranean stem (*rhizoma*; *caudex*; *fern root*, *radix filicis*, officin.) lies obliquely in the ground. It varies in length and breadth, according to its age. For medical purposes it should be from three to six or more inches long, and from half an inch

to an inch or more broad. It is almost completely enveloped by the thickened bases of the footstalks of the fallen leaves. These bases (*phyllopodia*) are arranged closely around the rhizome in an oblique direction, overlapping each other. They are one or two inches long, from three to five lines thick, curved, angular, brown, surrounded near their origin from the rhizome by two or more shining, reddish yellow, thin, silky scales (*ramenta*). The radicle fibres (root, properly so called) arise from the rhizome between these footstalks.

The *fern root of the shops* consists of fragments of the dried thickened bases of the footstalks (*phyllopodia*), to which small portions of the rhizome are found adhering, and of the root fibres.

Internally, the rhizome and footstalks are, in the recent state, fleshy, of a light yellowish-green colour; but in the dried state, yellowish or reddish-white. Iodine colours the fresh rhizome bluish black, indicating the presence of starch; particles of which may be recognized by the microscope. In a transverse section of the

Fig. 197.

*Nephrodium Filix mas.*

A. Fresh rhizome entire.

a. Spirally-coiled young frond.

b b b. Leaf-stalks (*stipites*) cut off.

c c. Root-fibres.

B. Transverse section of the fresh rhizome.

a. Transverse section of the stem, with the vascular bundles.

b b b b b. Bases of the leaf-stalks, called *phyllopodia*. They surround the stem in a circular manner, and are devoid of vascular bundles.

¹ Liv. iv. cap. clxxxvi. and clxxxvii. Sibthorp (*Prodr. Fl. Græcæ*, vol. ii. p. 274) puts a query whether *Aspidium aculeatum*, Willd. be not the *πτέρις* of Dioscorides? But in the *Pharmacopœa Græca* of 1837, *πτέρις* is given as the modern Greek name of *Aspidium Filix mas*.

² *Hist. Nat. lib. xxvii. cap. lv.*

rhizome, we observe five or six, or more, bundles of woody fibres and scalariform ducts. These bundles are arranged in a circle, are of a reddish-white colour in the recent rhizome, but yellow in the dried one.

The dried root has a feeble, earthy, somewhat disagreeable odour. Its taste is at first sweetish, then bitter astringent, and subsequently nauseous, like rancid fat.

COLLECTION.—The rhizome should be collected in the month of July, August, or September. The black portions, fibres, and scales, are to be removed, and the sound parts carefully dried and reduced to powder: this is of a yellowish colour, and is to be preserved in well-stoppered bottles. Both the whole rhizome and powder deteriorate by keeping.

Fern buds (*gemmæ filicis maris*) which are sometimes employed in medicine, are to be collected in the spring.

COMPOSITION.—Fern rhizome was analyzed in 1805 by Vauquelin,¹ in 1821 by Gebhard,² in 1824 by Morin,³ in 1826 by Wackenroder,⁴ and by Geiger.⁵ Subjoined are the results of the analyses of Geiger and Morin:—

Geiger.		Morin.	
Green fat oil	6.9	Volatile oil.	
— resin	4.1	Fixed oil (stearin and olein).	
Uncrystallizable sugar }	22.9	Tannin.	
Easily oxidizable tannin }	22.9	Galic and acetic acids.	
Gum and salts, with sugar and tannin . . . . .	.8	Uncrystallizable sugar.	
Ligneous fibre and starch	56.3	Starch.	
	100.0	Gelatinous matter, insoluble in water and alcohol.	
		Ligneous fibre.	
		Ashes (carbonate, sulphate, and hydrochlorate of potash, carbonate and phosphate of lime, alumina, silica, and oxide of iron).	

The anthelmintic property of the rhizome resides in the oil (*oleum filicis maris*). Luck⁶ obtained from the granular sediment which forms in oil of fern, tabular rhombic plates, whose formula was $C^{59}H^{38}O^{20}$ (probably it should be $C^{60}H^{36}O^{20}$), a brown substance soluble in alcohol and alkaline liquids, and whose formula was $C^{105}H^{54}NO^{45}$, and a gray body, insoluble in all solvents, except caustic alkalies, and whose formula was $C^{24}H^{12}NO^3$.

Batso⁷ found a peculiar acid (*acidum filiceum*) and an alkali (*filicina*) in the rhizome.

Fern buds contain, according to Peschier,⁸ a volatile oil, brown resin, fat oil, solid fatty matter, green-colouring principle, a reddish-brown principle, and extractive.

CHARACTERISTICS.—The presence of tannic acid in the aqueous decoction of fern rhizome is shown by the sesquisalts of iron producing a dark green colour (*tannate of iron*), and by a solution of gelatin causing a yellowish precipitate (*tannate of gelatin*). No indication of the presence of a vegetable alkali in the decoction can be obtained by tincture of nutgalls. If the rhizome be digested in alcohol, and afterwards boiled in water, the decoction when cold forms, with a solution of iodine, a dingy blue precipitate (*iodide of starch*).

PHYSIOLOGICAL EFFECTS.—These are not very obvious; but they are probably similar to those caused by other astringents. Large doses excite nausea and vomiting.

USES.—It is only employed as an anthelmintic. Theophrastus, Dioscorides, Pliny, and Galen, used it as such. The attention of modern practitioners has been directed to it principally from the circumstance of its being one of the remedies employed by Madame Nouffer, the widow of a Swiss surgeon, who sold her secret method of expelling tape-worm to Louis XVI. for 18,000 francs.⁹ At the present time fern rhizome is but seldom employed in this country, partly because the efficacy of Madame Nouffer's treatment is referred to the drastics used, and partly because

¹ Ann. Chim. iv. 31.

² Journ. de Pharm. x. 223.

³ Handb. d. Pharm. 1829.

⁴ Ann. der Chem. u. Pharm. Bd. liv. 1845; also Chem. Gazette, vol. iii. p. 369.

⁵ Inaug. Diss. 1826, quoted in Goebel and Kunze's Pharm. Waarenk.

⁶ Quoted by Soubeiran, Nouv. Traité de Pharm. t. ii. p. 159, 2nd Ed.

⁷ Trait. contre le Tania, &c. 1776, quoted by Bremser, Sur les Vers Intest.

⁸ Diss. inaug. in Pfaff's Syst. d. Mat. Med. 7er Bd. 219.

⁹ De Anthelm. regni Vegetab.

other agents (especially oil of turpentine) have been found more effectual. "It is an excellent remedy," says Bremser,¹ "against *Bothriocephalus latus* [the tape-worm of the Swiss], but not against *Tænia Solium* [the tape-worm of this country]; for though it evacuates some pieces of the latter, it does not all of it."

ADMINISTRATION.—It may be administered in the form of powder, of oil or ethereal extract, or of aqueous decoction. The dose of the recently prepared powder is from one to three drachms. Madame Nouffer's *specific* was two or three drachms of the powder taken in from four to six ounces of water in the morning fasting, and two hours afterwards a *purgative bolus*, composed of calomel ten grains, scammony ten grains, and gamboge six or seven grains. The bolus was exhibited to expel the worm which the fern rhizome was supposed to have destroyed.

The *Ethereal Tincture of Male Fern Buds* (prepared by digesting 1 part of the buds in 8 parts of ether) has been used with success by Dr. Peschier (brother of the chemist of that name), and by Dr. Fosbroke² as a vermifuge.

OLEUM FILICIS MARIS; Oil of Male Fern.—The impure oil of fern (called *oilum filicis Peschieri*, *extractum filicis æthereum*, seu *balsamum filicis*), recommended by Peschier,³ is an ethereal extract, and is composed, according to its proposer, of a fatty matter, resin, volatile oil, colouring matter, extractive, chloride of potassium, and acetic acid. A pound of the rhizome yielded Soubeiran⁴ an ounce and a half of thick black oil, having the odour of fern. It may also be prepared from the buds as above stated. The dose is from half a drachm to a drachm, in the form of electuary, emulsion, or pills: an hour afterwards, an ounce or an ounce and a half of castor oil should be exhibited. Numerous testimonies of its efficacy have been published.⁵ I have tried it in several cases of tape-worm, but without success. By substituting alcohol for ether, twelve or thirteen drachms of oil can be obtained from 2½ lbs. of the rhizome.⁶

30. *Adiantum*, Linn.—Maidenhair.

HISTORY.—The term *Maidenhair* or *Capillary* (*Capillaris*, Apuleius; *Capillaire*, Fr.) has been applied to several species of fern which have been used in medicine. Dioscorides (lib. iv. cap. 136 and 137) and Pliny (lib. xxii. cap. 30) notice two kinds, one termed *Adianton*, *Polytrichon*, or *Callitrichon* (ἀδιαντον, πολύτριχον, καλλιτριχον), the other called *Trichomanes* (τριχομανές). The former is supposed by Sibthorp⁷ to be the *Adiantum Capillus Veneris*, Linn., or *True Maidenhair*, the latter the *Asplenium Trichomanes*, Linn. *Common Maidenhair Spleenwort* of modern botanists. In later times, other ferns have been also employed under the name of *Maidenhair*; especially *Asplenium Adiantum nigrum*, Linn. or *Black Maidenhair Spleenwort*; *Asplenium Ruta muraria*, Linn. *Wall-rue* or *White Maidenhair*, formerly called *Salvia Vita*; *Ceterach officinarum*, DC., or *Rough Spleenwort*; and *Scolopendrium vulgare*, Smith, or *Common Hart's-tongue*. To these must be added, *Adiantum pedatum*, Linn. or *Canadian Maidenhair*, and *Adiantum trapeziforme*, Linn. or *Mexican Maidenhair*.

The only species which it will be necessary here to notice are, *Adiantum Capillus Veneris* and *A. pedatum*.

BOTANY. Gen. Char.—*Sporangia* placed on the distinct points of the veins in a linear or point-like receptacle, arranged in marginal *sori*. *Indusia* continuous with the edge of the frond, united to the receptacle, opening inward (*Endlicher*).

1. *A. Capillus Veneris*, Linn.; Frond bipinnate, pinnules thin, membranaceous, obovate-cuneate inciso-sublobate, segments of the fertile pinnules terminated by a linear oblong sorus, sterile ones serrated (*Hooker*).—Indigenous. Perennial. May—September.

2. *A. pedatum*, Linn. Frond pedate, divisions pinnate, pinnae halved, oblong lunate, incised at the upper edge, the sterile segments toothed; sori linear; petiole smooth.—North America.

DESCRIPTION.—The officinal part of *Maidenhair* is the frond, or rather the whole plant without the root.

The herb of *True Maidenhair* (*herba capillorum veneris*) is sold at herb-shops in the dried state. When rubbed, it has a feeble odour, and its taste is sweetish and bitterish.

The herb of *Canadian Maidenhair* (*herba capillorum veneris canadensis* vel *adianthi pedati*) is more aromatic than the preceding.

¹ *Op. cit.* p. 422.

² *Journ. génér. de Med.* 1835, p. 375.

³ Dierbach, *Neuesten Entd. in d. Mat. Med.* Band 1, 1837.

⁴ *Journ. de Chim. Méd.* t. v. 2nde Sér. p. 68.

⁵ *Lancet* for 1834-35, vol. ii. p. 597.

⁶ *Nouv. Traité de Pharm.* ii. 161, 2nde éd.

⁷ *Prodr. Fl. Græcæ*, vol. ii.

COMPOSITION.—No analysis has been made of these species of *Adiantum*. The most important constituents appear to be *tannic* or *gallic acid*, *bitter extractive*, and a *volatile oil*.

EFFECTS AND USES.—None of the sorts of Maidenhairs appear to be endowed with any active powers; though a great variety of imaginary properties have been ascribed to them. They are mucilaginous, bitterish, somewhat astringent, and aromatic substances; and in modern times have been used as pectorals in chronic catarrhs. The Canadian Maidenhair (*Adiantum pedatum*, Linn.) is the most esteemed sort, on account of its stronger and more agreeably aromatic qualities.

A *Syrup of Maidenhair* (*Syrupus Adianthi*; *Syrupus Capilli Veneris*; *Sirope de Capillaire*), prepared by adding sugar and orange-flower water to an infusion of Maidenhair, has long been popular. Both Baumé and the French Codex direct it to be prepared with the Canadian Maidenhair. When diluted with water, it forms a very refreshing beverage. But as the Maidenhair serves no essential purpose in this drink, it is usually omitted, and the syrup sold in the shops under the name of *capillaire* is nothing but clarified syrup flavoured with orange-flower water. The Prussian and Hamburgh Pharmacopœias authorize this substitution by giving formulæ for a *syrupus florum aurantii* to be used in “*loco syrupi capillorum veneris*.”

ORDER V. LYCOPODIACEÆ, DC.—CLUB-MOSSES.

CHARACTERS.—Herbaceous or shrubby vascular terrestrial plants. *Stem* terete, branched, leafy. *Leaves* inserted spirally on the stem, imbricated, simple, sessile or decurrent, never articulated. *Spore-cases* (*sporangia*; *thece*; *sporangia*) axillary, mostly uniform, sometimes, on the same individuals bifurc; some bivalved, containing a farinaceous powder, composed of polygonal smooth or papillose-spinulose granules (*spores*; *pollen*?); others 3-4-coccous, 3-4-valved, containing a few (usually 3 or 4) somewhat globular corpuscles (*spores*? *gemmæ* or *buds*?) marked at the vertex with a three-legged raphe.

PROPERTIES.—These are but little known.

An acrid principle resides in several species. Both *Lycopodium clavatum* and *L. Selago* act as emetics. The latter species, called *muscus catharticus* seu *erectus*, and supposed to be the *Selago*¹ of the Druids, has also been employed as a cathartic emmenagogue, and to produce abortion. In large doses it operates as a narcotico-acrid poison. A decoction of it is sometimes employed by the peasants of Sweden, and other places, as a lotion to destroy pediculi on the skin of horses, cows, pigs, &c.² Dr. Buchner³ has recorded some cases of accidental poisoning by it, in which it caused staggering and sickness. *Lycopodium catharticum*, Hooker (*L. rubrum*, Chamisso) is also a violent purgative. Some species, e.g. *Lycopodium Phlegmaria*, Linn., and *Selaginella convoluta*, Spring (*L. hygrometricum*, Mart.) are reputed aphrodisiacs.

31. *Lycopodium clavatum*, Linn.—Common Club-Moss.

(Herba; Sporulæ.)

HISTORY.—The earliest writers by whom the medicinal qualities of this plant are distinctly referred to, are the herbalists (Brunfels, Tragus, Cordus, &c.) of the 16th century.

BOTANY. **Gen. Char.**—*Spore-cases* unilocular, uniform or bifurc; the *fariniferous* ones subreniform, and bivalved; the *globuliferous* ones somewhat globose, 3-4-lobed, 3-4-valved. (*Endlicher, Gen. Pl.*)

Sp. Char.—*Stem* creeping; branches ascending; *leaves* linear-lanceolate, nerveless, terminating at the point in a bristle; *spikes* in pairs, stalked, cylindrical; *bracts* ovate, acuminate, premorse, toothed (*Endl. Med. Pflanzen*).

Roots of several strong scattered fibres. *Stems* procumbent, trailing, branching, leafy, several feet in length. *Leaves* crowded, curved upwards, linear-lanceolate, flat, ribless, smooth, deep green, partly serrated, tipped with a capillary point; those of the branches erect; the upper ones loosely dispersed. *Spikes* terminal, usually in pairs, rarely one, or three, densely beset with shortened, dilated, ovate, entire, long-pointed *leaves* or *scales*, in whose bosoms the small, sulphur-coloured *capsules* [*thece*] are situated (*Smith*).

Hab.—Mountainous heaths and moors all over Europe. Indigenous. Perennial. July, August.

¹ Pliny, *Hist. Nat. lib. xxiv. cap. 65.*

² *Reperl. für d. Pharmacie*, Bd. xiv. s. 311, 1823.

³ Murray, *App. Medicam.* vol. v. p. 493.

Fig. 198.

*Lycopodium clavatum.*

a. Scale of a spike with a capsule (magnified).

DESCRIPTION.—1. *Sporulæ Lycopodii.* The powder sold in the shops under the name of *lycopodium* (*pulvis, farina, pollen, seu semina lycopodii*), *witch-meal*, or *vegetable sulphur* (*sulphur vegetabile*), consists of granules, usually regarded as sporules, but by some considered to be grains of pollen. In both their physical and chemical properties they resemble the latter. They are gathered towards the end of the summer, and are separated from the capsules, &c., by sifting.

Lycopodium is a very fine, odourless, tasteless, and very mobile powder, of a pale-yellow colour. It adheres to the fingers, but exhibits a repulsive force for water, and hence is with difficulty mixed with it. If strewed on this liquid it floats, and the hand may be dipped to the bottom without being moistened. If shaken up with water a portion of it sinks, but the greater part floats. With spirit of wine it is readily miscible. It is tinged brown by iodine. When thrown into the flame of a candle it burns with great rapidity, producing an instantaneous flash of yellowish-white light.

When moistened by spirit of wine, or, still better, by oil of vitriol, and examined by the microscope, the granules are found to have the shape of tetrahedrons, with a convex base; or they may be described as spheroids, on a portion of whose surface there are three faces, or planes, uniting to form a three-sided pyramid. The faces appear to have been produced by the mutual pressure of the granules on each other, while in the spore-cases. The external membrane forms reticulated elevations, with intervening depressions or pits, giving a cellular appearance to the surface of the granules. The three-legged mark, at the union of the three planes, appears to be formed by a cleft in the membrane.

Fig. 199.

*Sporules of Lycopodium clavatum*
(highly magnified).

2. *Herba Lycopodii* (*Herba musci clavati terrestris*). This is odourless; at first sweetish, and then bitterish. Digested in water it yields a yellowish infusion, whose colour is deepened by sesquichloride of iron.

COMPOSITION.—*Lycopodium* sporules have been analyzed by Bucholz¹ and by Cadet.² The former chemist obtained the following results: *Fat oil*, 6.0; *sugar*, 3.0; *mucilaginous extract*, 1.5; and *pollenin*, 89.5. The substance called pollenin is, however, a complex organized body, and cannot be regarded as a proximate principle. By the action of caustic potash on *lycopodium*, Muspratt³ has shown that acetic acid is obtained.

The herb has not been analyzed. It appears to contain some acrid principle.

ADULTERATION.—As met with in the London shops, I have never found *lycopodium* (the sporules) adulterated.

The sporules of other species of *Lycopodium* are said to be sometimes substituted for those of *L. clavatum*: the microscope alone can detect the difference.

The pollen of some plants, as of *Typha latifolia*, and of some coniferous plants, is said to be sometimes substituted for the *lycopodium* sporules. The microscope readily distinguishes the substitution. The shape, the size, the character of the surface, and the cohesion or isolation of the grains, must be attended to in distinguishing them. The pollen of coniferous plants is also sometimes recognizable by its terebinthinate odour when rubbed in the hand: that of *Typha latifolia* is not so inflammable as genuine *lycopodium* meal.

Starch, talc, gypsum, chalk, boxwood powder, &c. &c., have been reported as adulterating substances. By throwing the suspected *lycopodium* on water, the mineral substances present would readily fall to the bottom, and might be detected by their appropriate chemical tests. Iodine and the microscope will detect starch. Boxwood powder has been separated from *lycopodium* by a fine sieve, which let the genuine sporules through, but retained the wooden particles.

Once I have seen *lycopodium* infected by a fungus, the matted mycelium of which had a slate colour, and a membranous or papery appearance.

EFFECTS.—1. *Of the sporules*.—Applied externally, *lycopodium* acts as an absorbent and desiccant. Taken internally, it is reputed to possess demulcent, sedative, and diuretic properties; but these qualities are of doubtful existence.

2. *Of the herb*.—The herb appears to be endowed with some active properties. It acts as an emetic and cathartic, and is reputed to possess diuretic and emmenagogue qualities.

USES.—1. *Of the sporules*.—*Lycopodium* is used both medicinally and pharmaceutically, as well as in the arts.

It is applied as a dusting powder to excoriated surfaces, especially the intertrigo of infants, and to parts affected with erysipelas, herpetic ulceration, eczema, &c. It is sometimes used in the form of ointment. In Poland, it is popularly employed as an external application in *plica polonica*. As an internal remedy, its powers are very doubtful. It has, however, been used by Wedelius and others,⁴ and, in later times, by Hufeland, Jawandt, Rademacher, and Busser,⁵ in the retention of urine, and flatulent colic of infants; and in calculous complaints, hemorrhoids, gout, &c., of adults.

In pharmacy, it is used for enveloping pills and boluses. It serves both to isolate the pills and cover their taste.

But its principal use is at theatres, where it is employed for filling flash-boxes, and for producing artificial lightning. It is also used in pyrotechny. Gray says that females employed in delicate works use it to keep their hands free from sweat.

2. *Of the herb*.—This is rarely employed. It has been celebrated in the treatment of *plica polonica*, and, in consequence, has been called *plicaria*. It was employed in the form of decoction, both externally, as lotion and liniment, and

¹ Berlin. *Jahrb. für d. Pharm.* 1807, S. liv.; also L. Gmelin's *Handb. d. Chem.*

² *Bull. de Pharm.* t. iii. p. 31, 1811.

⁴ Murray, *App. Med.* vol. v.

⁵ *Pharmaceutisches Central-Blatt für 1844*, S. 904.

⁵ Hufeland's *Journal*, Bd. ii. iv. and xxxvi.

internally.¹ More recently it has been recommended by Dr. Rodewald² in retention of urine, from gravel, or pus [!], in atony of the muscular coat of the bladder, in weakness and relaxation of the inner membrane of the bladder, and as a diuretic. He states that he has used it for many years with great success.

ADMINISTRATION.—The *sporules* are administered internally in doses of from ten grains to a scruple, in the form of a mixture, or emulsion, made with syrup, mucilage, or yolk of egg. Externally, they are sometimes used in the form of ointment, composed of one drachm of lycopodium to an ounce of lard. The *herb* is administered in the form of decoction or infusion. Two up-heaped tablespoonfuls, with a pint of water, are to be boiled to one-half; and of this decoction a teacupful may be taken every ten minutes, or at longer intervals. In a more dilute state it may be drank as a tea.

II. Phanerogamia, *Auct.*—Phanerogams or Flowering Plants.

COTYLEDONEÆ, *Juss.*—EMBRYONATÆ, *Rich.*—VASCULARES, *De Cand.*

CHARACTERS.—Substance of the plant composed of cellular tissue, woody fibre, ducts, and spiral vessels. *Leaves* usually present; *cuticle* with stomata. *Flowers* with perceptible stamens and pistils. *Seeds* with an embryo enclosed within a spermoderm, furnished with one or more cotyledons.

Class III. Endogenæ, *DC.*—Endogens.

MONOCOTYLEDONES, *Juss.*

CHARACTERS.—*Trunk* usually cylindrical, when a terminal bud only is developed, becoming conical and branched when several develop: consisting of cellular tissue, among which the vascular tissue is mixed in bundles, usually without any distinction of bark, wood, and pith, and destitute of medullary rays; increasing in diameter by the addition of new matter to the centre. *Leaves* frequently sheathing at the base, and not readily separating from the stem by an articulation, mostly alternate, generally parallel-veined, rarely netted. *Flowers* usually having a ternary division; the calyx and corolla either distinct or undistinguishable in colour and size, or absent. *Embryo* with but one cotyledon; if with two, then the accessory one is imperfect, and alternate with the other; *radicle* usually enclosed within the substance of this embryo, through which it bursts when germinating (*Lindley*, chiefly).

This class includes two subclasses: 1. *Glumaceæ*, or glumaceous endogens. 2. *Petaloidæ*, or endogens, whose floral envelopes, if present, are whorled.

Sub-class I. *Glumaceæ*, *Endl.*

CHARACTERS.—*Flowers* disposed in spikelets, and enclosed within imbricated bracts. *Ovary* free, unilocular, containing one erect ovule. *Fruit* a caryopsis. *Embryo* at the base of farinaceous albumen.

This class includes two orders: 1. *Graminææ*, or glumaceous endogens with round stems, leaves having split sheaths, and embryo lying on the outside of the albumen. 2. *Cyperaceæ*, or glumaceous endogens with angular stems, leaves with entire sheaths, and embryo included within the albumen.

¹ Vicat, *Mémoire sur la Plaque Polonoise* (Murray, *App. Med.*).

² No. 16. *Alttenberger medicinische Zeitung*, 1833. (Quoted by Dierbach, *die neueste Entd. in d. Mat. Med.* Bd. i. S. 56, 1837.)

ORDER VI. GRAMINEÆ, *R. Brown.*—GRASSES.GRAMINA, *Juss.*—GRAMINACEÆ, *Lind.*

CHARACTERS.—*Flowers* usually hermaphrodite, sometimes monœcious or polygamous; consisting of imbricated bracts, of which the most exterior are called *glumes*, the interior immediately enclosing the stamens *paleæ*, and the innermost at the base of the ovary *scales*. *Glumes* usually 2, alternate; sometimes single; most commonly unequal. *Paleæ* two, alternate; the lower or exterior simple; the upper or interior composed of 2, united by their contiguous margins, and usually with 2 keels, together forming a kind of dislocated calyx. *Scales* 2 or 3, sometimes wanting; if 2, collateral, alternate with the paleæ, and next the lower of them, either distinct or united. *Stamens* hypogynous, 1, 2, 3, 4, 6, or more, 1 of which alternates with the 2 hypogynous scales, and is, therefore, next the lower paleæ; *anthers* versatile. *Ovary* simple: *styles* 2 or 3, very rarely combined into 1; *stigmas* feathery and hairy; *ovule* ascending by a broad base, anatropal. *Pericarp* usually undistinguishable from the seed, membranous. *Albumen* farinaceous; *embryo* lying on one side of the albumen at the base, lenticular, with a broad cotyledon and a developed plumule; and occasionally, but very rarely, with a second cotyledon on the outside of the plumule, and alternate with the usual cotyledon.—*Evergreen herbs*. *Rhizoma* fibrous or bulbous. *Stems* cylindrical, usually fistular, closed at the joints, covered with a coat of silex, sometimes solid. *Leaves* narrow and undivided, alternate, with a split sheath, and a membranous expansion (*ligula*) at the junction of stalk and blade. *Flowers* in little spikes, called *locustæ*, arranged in a spiked, racemed, or paniced manner (*Lindley*).

PROPERTIES.—Considered with reference to their ultimate or mineral constituents, the grasses are remarkable for the large proportion of *silica*, *potash*, and *phosphoric acid*, and for the small proportion of *chlorine* which they contain. The silica predominates in the leaves and stem, the phosphoric acid in the seeds. The following table¹ represents the mean composition of the ashes of the most important cereal grains.

MEAN PER CENTAGE COMPOSITION OF THE ASH OF THE FOLLOWING CEREAL GRAINS:—

	Wheat.	Barley (with the husk).	Oat.	Rye.	Indian corn.	Rice.
Potash	23.72	13.61	26.18	{ 22.08	{ 32.48	{ 18.48
Soda	9.05	8.14		{ 11.67		{ 10.67
Lime	2.81	2.62	5.95	4.93	1.44	1.27
Magnesia	12.03	7.46	9.95	10.35	16.22	11.69
Oxide of iron	0.67	1.45	0.40	1.36	0.30	0.45
Phosphoric acid	49.81	38.93	43.84	49.55	44.87	53.36
Sulphuric acid	0.24	0.10	10.45	0.98	2.77	..
Chlorine . . . . .	..	0.04	0.26	..	0.18	0.27
Silica	1.17	27.10	2.67	0.43	1.44	3.35
Alumina . . . . .	..	0.21	0.06	..	..	..
	99.50	99.72	99.76	101.35	99.70	99.54
Per centage of ash	about 2.0	2.84	2.18	2.425	about 1.5	1.00

The following table, drawn up by M. Payen,² shows the proportions of the proximate or immediate principles of the cereal grains:—

100 parts of	Starch.	Gluten, and other Azotized Matters. ³	Dextrine. Glucose, or Congenerous Substances.	Fatty Matters.	Cellulose.	Silica, Phosphates of Lime, Magnesia, and Soluble Salts of Potash and of Soda.
Wheat, hard, of Venezuela	58.12	22.75	9.50	2.61	4	3.02
“ “ of Africa	64.57	19.50	7.60	2.12	3.50	2.71
“ “ of Taganrog	63.30	20.00	8	2.25	3.60	2.85
“ demi-hard, of Brie (France)	68.65	16.25	7	1.95	3.40	2.75
“ white tuzelle	75.31	11.20	6.05	1.57	3	2.12
Rye	65.65	13.50	12	2.15	4.10	2.60
Barley	65.43	13.96	10	2.76	4.75	3.10
Oats	60.59	14.39	9.25	5.50	7.06	3.25
Maize	67.55	12.50	4	8.80	5.90	1.25
Rice	89.15	7.05	1	0.60	3	0.90

¹ Drawn up from the calculated means contained in Johnston's *Lectures on Agricultural Chemistry and Geology*, 2d edit. 1847.

² *Précis de Chimie Industrielle*, p. 394, Paris, 1849.

³ The proportions of azotized substances have been deduced from the elementary analysis by multiplying by 6.5 the weight of azote obtained.

Of the proximate or organic constituents of grasses, *starch* and *sugar* are found in large proportion, the former in the seed, the latter in the stem. These constituents, with *proteinaceous matter* (gluten, albumen), to which may be added *gum*, confer on corn its valuable nutritive properties. (For the per centage proportion of starch and proteinaceous matter in corn, see *ante*, p. 106, and vol. i. p. 119.)

Fragrant volatile oils are obtained from herbaceous parts of some grasses. Several of these are employed in perfumery and in medicine (see the genus *Andropogon*).

The grasses are remarkable for their deficiency of pectin, as well as of pectic, tartaric, citric, and other vegetable acids commonly found in plants.

Considered with regard to their dietetical uses, the grasses are most important and valuable to man. They contain nitrogenized principles fitted for the production of the essential constituents of the blood and of the organized tissues, and also non-nitrogenized principles for the production of fatty matters, lactic acid, and, by combustion, of heat. The following table gives a general view of the uses which several constituents of grains of corn serve in the animal economy:—

	Corn.	Blood.	Organs.	Excreta.
1. Complex nitro-genized substances.	{ Gluten Albumen }	{ Fibrine Albumen Hæmatin }	{ Fibrine, albumen, hæmatin, gelatine, chondrine, kreatin, kreatinin, inosinic acid. }	{ Urea, uric acid, hippuric acid, kreatin, kreatinin, horny matter (in hair, nails, and epidermis). }
2. Complex non-nitro-genized substances.	{ Starch Sugar Gum }	{ Fat Sugar Lactic acid }	{ Fat Sugar Lactic acid }	{ Carbonic acid. Water. (Caloric.) }
3. Mineral substances.	{ Potsh, soda, lime, magnesia, iron, phosphoric acid, sulphur (in gluten, &c.), (fluor?), chlorine, silica. }	{ Potsh, soda, lime, magnesia, iron, phosphoric acid, sulphur (in fibrine, albumen, &c.), (fluor?), chlorine, silica? }	{ Potsh, soda, lime, magnesia, iron, phosphoric acid, sulphur (in fibrine, albumen, gelatine, &c.), fluor, chlorine, silica. }	{ Potsh, soda, lime, magnesia, iron, phosphoric acid, sulphur, sulphuric acid, chlorine, fluorine, silica. }
4. Water . .	Water =	Water =	Water =	Water.

Almost every species of grass is wholesome. Some supposed exceptions to this statement have been already noticed (see vol. i. pp. 134 and 135). Of these, the best established is *Lolium temulentum*, which will be presently noticed. In a state of disease, corn sometimes acquires most important and valuable medicinal properties. (See *Ergot*.)

TRIBE I. ORYZEÆ, *Endl.*

32. *Oryza sativa*, *Linn.*—Common Rice.

Sex. Syst. Hexandria, Digynia.
(Semina.)

SYNONYMES.—*Ὠρυζον*, Theophr. Hist. Plant, lib. iv. cap. 5; *ῥυζα*, Dioscor., lib. ii. cap. 117; Galen, de simpl. med. facult., lib. viii. cap. xv. 16; *Oryza*, Pliny, Hist. Nat., lib. xviii. cap. 13.

BOTANY.—*Stems* numerous, 2 to 8 or 10 feet long. *Leaves* long and slender. *Panicle* diffuse thin, bowing when the seed is weighty. *Spikelet* hermaphrodite, 1-flowered; *glumes* 2, small; *paleæ* 2; *scales* 2, smooth; *stamens* 6; *ovary* sessile; *styles* 2; *stigma* feathery. *Caryopsis* compressed, enclosed by the paleæ.—Originally a native of Asia. Extensively cultivated in India, China, the Indian Archipelago, and most other Eastern countries; in the West Indies, Central America, and the United States; and in some of the Southern countries of Europe. Forty or fifty varieties¹ are known to and cultivated by the Indian farmers; of these some are awned—others are awnless. The kinds most esteemed in this country are the *Carolina* and *Patna rice*. Patna rice is imported in bags holding 1½ cwt. each. It has usually been mixed with lime, to prevent the attacks of insects. The grain, whilst enclosed in the paleæ or husk, is called *paddy* (*padi* or *paddie*) by the Malays, *bras* when deprived of the husk, and *nasi* after it has been boiled.

COMPOSITION.—Rice has been analyzed by Vauquelin,² by Braconnot,³ by Vogel,⁴ and by d'Arcet and Payen⁵ (see *ante*, p. 106). The composition of Carolina and Piedmont rice is, according to Braconnot, as follows:—

¹ Roxburgh, *Flora Indica*, vol. ii. p. 200, 1822.

² *Mém. du Muséum d'Hist. Nat.* t. iii. p. 229, 1817.

³ Quoted by L. Gmelin, *Handb. d. Chemie*, Bd. ii. S. 1345.

⁴ *Journ. de Chimie Méd.* t. ix. p. 221, 1833.

⁵ *Ann. Chim. Phys.* t. iv. p. 383, 1818.

Fig. 200.

COMPOSITION OF RICE.

Carolina Rice. Piedmont Rice.

Starch	85.07	83.80
Parenchyma (woody fibre)	4.80	4.80
Glutinous matter	3.60	3.60
Rancid, colourless, tallowy oil	0.13	0.25
Uncrystallizable sugar	0.29	0.05
Gum	0.71	0.10
Phosphate of lime	0.40	0.10
Water	5.00	7.00
Acetic acid, phosphate of potash, chloride of potassium, and vegetable salts of potash and lime.	traces	traces
	100.00	100.00

*Oryza sativa*.

a. Branch with awns.

The inorganic constituents of rice have been before stated (see *ante*, p. 106).

1. *Rice starch* is manufactured, under Mr. Orlando Jones's patent, as follows: Patna rice is first freed from stones, dust, &c., by a process analogous to winnowing, and is then digested whole in a solution of caustic soda containing 200 grains of soda to the gallon. The solution being poured off, the grain, which has thus been deprived of part of its gluten, is ground in a mill, and the ground rice mixed with a solution of the same strength, so as to form a mixture having the consistence of thick cream. More lye is then added, and the mixture stirred up for a few hours, and then left to deposit: a heavy matter, called *fibre* (heavy starch), deposits, while the starch (lighter starch) remains suspended. The liquor is then run off into shallow vessels, where the starch deposits: the alkaline solution of gluten is then drawn off, and the starch repeatedly washed with water and then allowed to deposit. The starch mass is now obtained of the consistence of clay. It is then usually mixed with blue colouring matter (snalt), to fit it for the use of the laundress, and removed to draining-boxes, which are lined with cloth. These consist each of two cells, whose size is 3 feet long, 6 inches deep, and 6 inches broad. Here the starch forms a lump or mass of the shape and size of the cell, and is afterwards cut into 6 cubical blocks, which are placed on chalk-stones to drain, and are then partially dried in a stove, to produce what is called *crusting*. The crust is scraped off, the block wrapped in paper and returned to the stove to dry, when it splits into the columnar masses commonly known as the *races* of the starch. If, instead of crusting the lumps, the starch were slowly dried, decomposition is apt to take place; and, if rapidly dried, the races are apt to be small and needle-like. 100 lbs. of Patna rice, as it occurs in the market, yield from 80 to 85 lbs. of good marketable starch, 7.5 lbs. of fibre, the remainder being gluten, gruff or bran, and a small quantity of light starch, carried off in suspension in the alkaline liquor.

Vogel states that, from dried rice, he obtained 96 per cent. of starch.

When examined by the microscope, the granules are observed to be polygonal, and very minute; their average diameter being about $\frac{1}{32}$ part of an inch.¹ They are the smallest granules of all the commercial starches. According to Vauquelin, rice starch begins to dissolve in water at from 122° to 132° F.

Two kinds of rice starch are found in the shops: one, prepared under Orlando Jones's patent; the other, called *Mechlin glaze starch*, manufactured by Mottram, Rehé & Co.

2. *Proteine matters*.—Rice contains a much smaller proportion of the so-called *gluten* than wheat does. According to Horsford² and Payen (see *ante*, p. 106, and vol. i. p. 119), the quantity is about 7 per cent.

The substance which the rice starch-makers term gluten is analogous to what Mulder calls *proteine*, being obtained by carefully neutralizing the alkaline solution in which rice has been digested with an acid, by which a precipitate forms, which, when separated from the supermat liquor, has a creamy consistence, an agreeable smell, and a bland taste, like pap. By

¹ The following are measurements of the particles of rice starch made by my friend Mr. Jackson:—

	Inches.
1. . . . .	.00027
2. . . . .	.00021
3. . . . .	.0002
4. . . . .	.00017
5. . . . .	.0001
5).00095	

$$.00019 = \frac{1}{5253}$$

Most of the particles are angular; but the measurements were taken on those which most nearly approached the globular form.

² *Ann. Chem. u. Pharm.* Bd. xlviii. 1846.

evaporation, it forms a dark-coloured hard mass. If kept for some time in the moist state, it undergoes decomposition, and evolves an odour somewhat like sour yeast. Mixed with eggs, I have employed it, in the form of a baked pudding, in diabetes.

3. *Fatty matters*.—The quantity of fatty matter contained in rice is smaller than in other varieties of corn. The outer part of the grain appears to contain more than the inner part.

EFFECTS—Rice, though nutritious, is less so than wheat: this is proved by chemical analysis, which shows the much smaller proportion of glutinous or nitrogenous matter found in the former than in the latter grain (see *ante*, p. 106, and vol. i. p. 119). "Rice," says Boussingault,¹ "is held up as a most nutritive food; but though I have lived long in countries which produce it, I am far from considering it as a substantial nourishment. I have always seen it, in ordinary use, replace bread; and when it has not been associated with meat, it has been employed with milk."

The solid or dry part of rice does not materially differ from the solid or dry part of potatoes in the proportion of starch and gluten which it contains; and, therefore, as far as regards these two principles, the nutritive values of anhydrous rice and anhydrous potatoes are about equal. But, in some Union poor-houses, the substitution of an equal weight of boiled rice for potatoes was followed in a few months by scurvy.²

Rice, when swallowed in the raw state, swells up in the alimentary canal, and acts injuriously by the mechanical distension it gives rise to. Mr. Hovell³ has reported a case in which great pain, peritoneal inflammation, and death, arose from the ingestion of a tumblerful of raw rice.

"Rice," says Marsden,⁴ "is the grand material of food, on which a hundred million of the inhabitants of the earth subsist, and although chiefly confined by nature to the regions included between, and bordering on the tropics, its cultivation is probably more extensive than that of wheat, which the Europeans are wont to consider as the universal staff of life."

Rice is less laxative than the other cereal grains. Indeed, it is generally believed to possess a binding or constipating quality; and, in consequence, is frequently prescribed by medical men as a light, digestible, uninjurious article of food in diarrhœa and dysentery.

Various ill effects, such as disordered vision, &c., have been ascribed to its use;⁵ but, as I believe, unjustly so. Neither does there appear to me to be any real foundation for the assertions of Dr. Tytler,⁶ that malignant cholera (which he calls the *morbus oryzeus*, or *rice disease*) is induced by it.

USES.—Rice is employed as a nutriment in a variety of forms; e.g. *boiled rice*, *rice milk*, *rice pudding*, *rice cakes*, &c. In China, *rice vermicelli* is prepared from it. This is sold in flat bundles (of about 5 inches long, and 1½ inch broad), composed of a folded thread or filament made of rice paste. Medicinally, rice is employed as a demulcent, somewhat binding, nutritive substance in diarrhœa, &c. *Gardiner's alimentary preparation* is very finely ground rice meal.

TRIBE II. PHALARIDEÆ.

33. *Zea Mays*, Linn.—Indian Corn; Maize.

Sex. Syst. Monœcia, Triandria.

(Semina.)

HISTORY.—*Frumentum Indicum Mays dictum*, Casp. Bauhin, Pinax; *Frumentum vel Triticum Turcicum*; *Turkish Corn or Wheat*.—The first undoubted notice of this plant occurs in the works of Tiagus,⁷ who died in 1554; though by some writers it is thought to be referred to both in the Bible⁸ and in the works of Greek and Roman authors.⁹

BOTANY.—*Stem* 2 to 10 feet high. *Leaves* broad, flat, entire with a short ligula. *Flowers* monœcious; *males* terminal, racemose; *females* axillary, densely spiked. *Stamens* 3. *Ovary* sessile ovate. *Style* 1, long, capillary. *Stigma* ciliated. *Caryopsides* roundish or reniform, ar-

¹ *Ann. Chim. et Phys.* lxxvii. p. 413.

² *Provincial Medical and Surgical Journal*, June, 1847. Dr. Garrod (*Monthly Journal of Medical Science*, January, 1848) calculates that, prior to the substitution, the usual weekly food of the men in the Crediton Union contained 186 grains, and of the women 181 grains of potash; but, after the substitution, the weekly amount of potash taken by the men was about 51 grains, and by the women 46 grains, or a reduction of more than two-thirds: and he ascribes the occurrence of scurvy after the use of rice to the inferior proportion of potash which this grain contains in comparison with potatoes. We ought, however, also to take into consideration the fact that rice is deficient in certain vegetable acids found in the potato (see *ante*, p. 107).

³ *Lancet*, April 10th, 1847, p. 390.

⁴ *History of Sumatra*, p. 65, 3d ed. 1811.

⁵ Bontius, *Account of the Diseases, Natural History, &c. of the East Indies*, translated into English, 1769; also, Bricheteau in Tortuella's *Elem. d'Hygiène*, 4me éd.

⁶ *Lancet*, 1833-34, vol. i.

⁷ *De Stirpium Historia*, p. 651, 1532. (Sprengel, *Hist. Rei Herb.* t. i. p. 320, 1807.)

⁸ *Genesis*, ch. xli. ver. 5; *Leviticus*, ch. ii. ver. 14, ch. xxiii. ver. 14; *Matthew*, ch. xiii. ver. 1, &c. See Cobbett's *Treatise on Cobbett's Corn*, ch. ii. 13, 1828.

⁹ Both Theophrastus (*Hist. Plant.* lib. viii. cap. iv.) and Pliny (lib. xviii. cap. xiii.) mention a Bactrian corn of remarkably large size. Theophrastus says the grains were as large as olive stones; and Pliny states that they were as large as the ears of our corn. Pallas (*Synopsis Plant. Floræ Class.* p. 312, 1845) suggests that the *Σίτροπον* of Strabo (lib. xv.) may be our maize.

ranged on a large cylindrical receptacle or rachis, popularly called the *cobb*—An annual plant, indigenous in tropical America, but cultivated in various parts of the world.

The ordinary colour of the ripe grains or caryopsides is yellow; but they are frequently met with white, partly-coloured, red, purple, or even black.

Maize meal is sold in the shops under the name of *polenta*.

COMPOSITION.—Maize has been analyzed by Dr. Gorham,¹ by Bizio,² and more recently by Payen, whose analysis may be considered to have superseded his predecessors (see *ante*, p. 106).

Fig. 201.



Zea Mays.

a. Male flowers.

b, b, b, b. Female flowers. (The styles which project beyond the enveloping sheaths form a kind of tassel, popularly called the *silks*.)

8.79. More recently, Payen¹⁰ has given 8.80 per cent. as the proportion of oil found in maize.

EFFECTS.—Maize agrees generally with the other cereal grains in its nutritive properties (see *ante*, p. 107). It is remarkable for its fattening quality, and which probably depends on the larger amount of fatty matter contained in it than in other cereal grains. In those unaccustomed to its use, it is considered apt to excite or keep up a tendency to diarrhœa.

USES.—It is exclusively employed as an article of food.

¹ *Quarterly Journal of Science*, vol. xi. p. 206, 1821.

² L. Gmelin, *Handb. d. Chem.* ii. 1340.

³ The substance usually sold in the shops as *Indian corn starch* is potato starch.

⁴ *Repertory of Patent Inventions*, N. S. vol. xviii. p. 163, 1842.

⁵ The following measurements of seven (including the largest and smallest) grains of maize starch were made by Mr. George Jackson:—

1. . . . .	.0010	of an English inch.
2. . . . .	.0006	“ “
3. . . . .	.0005	“ “
4. . . . .	.0004	“ “
5. . . . .	.0003	“ “
6. . . . .	.0002	“ “
7. . . . .	.0001	“ “

⁶ *Ann. d. Chem. u. Pharm.* Bd. xlviii. 1846.

⁷ M. Guibourt (*Hist. Nat. des Drog. simpl.* t. ii. p. 129, 4me éd. 1849) says that the gluten of maize contains less nitrogen than that of other grasses.

⁸ *Comptes rendus*, Oct. 24, 1842.

⁹ *Annalen der Chemie und Pharmacie*, Bd. xlv. S. 126, 1843.

¹⁰ *Précis de Chim. Industrielle*, p. 394, 1849.

TRIBE III. AVENACEÆ.

34. AVENA SATIVA, Linn.—THE COMMON OAT.

Sex. Syst. Triandria, Digynia.

(Semen tunicis nudatum, L.—The seeds, E. D.)

HISTORY.—The oat is not mentioned in the Old Testament; but it is noticed by the ancient Greek¹ and Roman² writers, the former of whom called it βρώμος, the latter *avena*.

BOTANY. **Gen. Char.**—*Spikelets* three, many-flowered; flowers remote; the upper one withered. *Glumes* two, thin, membranous, awnless. *Paleæ* two, herbaceous; the lower one awned on the back, above the base, at the point almost bicuspidate; the upper one bicarinate, awnless; awn twisted. *Stamina* three. *Ovarium* somewhat pyriform, hairy at the point. *Stigmata* two, sessile, distant, villosoplumose; with simple hairs. *Scales* two, smooth, usually two-cleft, large. *Caryopsis* long, slightly terete, internally marked by a longitudinal furrow, hairy at the point, covered by the paleæ, adherent to the upper one (?) (Kunth).

Sp. Char.—*Panicle* equal. *Spikelets* two-flowered. *Florets* smaller than the calyx, naked at the base, alternately awned. *Root* fibrous, annual (Kunth).

Hab.—Cultivated in Europe.

A considerable number of varieties³ of this species are cultivated; these may be arranged under the two heads of *white oats* and the *red, dun, or black oats*.

The *white oats* have the paleæ of a whitish or straw colour. To this division belong the *potato oat*, the *Georgian oat*, the *Poland oat*, and the *Friesland or Dutch oat*.

The *red, dun, or black oats*, are so called on account of their colour.

Besides the *Avena sativa*, several other species of *Avena* are cultivated as oats. The following are the chief:—

Avena orientalis, Kunth.—*Tartarian, Hungarian, or one-seeded oat*. Cultivated in Europe.

Avena brevis, Kunth.—*Short oat*. Germany, Austria, and Hungary. Cultivated in France and Spain.

Avena nuda, Kunth.—*Naked oat*. Cultivated in Europe.

DESCRIPTION.—Oats (*caryopsides* vel *semina avenæ cruda*) are too well known to need description. As found in commerce, they are usually enclosed in the paleæ or husk. When deprived of their integuments, they are called *groats* (*semina integumentis nudata*, L.; *avena excorticata* seu *grutum*): these, when crushed, are denominated *Emden groats*. *Oatmeal* (*farina ex seminibus*, D.) is prepared by grinding the grains. It is not so white as wheaten flour, and has a somewhat bitterish taste.

COMPOSITION.—Oats have been analyzed by Vogel,⁴ by Payen,⁵ and, more re-

Fig. 202.



Avena.

- a. The white oat.
b. Siberian or Tartarian oat.

¹ Hippocrates *De virtutibus ratione*, lib. ii. sect. iv. p. 356, ed. Fœs.; Theophrastus, *Hist. Plant.* lib. viii. cap. 9; Dioscorides, lib. ii. cap. 116, and lib. iv. cap. 140; Galen, *De Atm. Facult.* lib. i. cap. 14, p. 322, tom. vi.—Fraas (*Synops. Plant. Floræ Classicæ*, p. 303, 1845) considers that the term βρώμος includes both *Avena sativa* and *A. fatua*, Linn.

² Pliny, *Hist. Nat.* lib. xviii. cap. 44.

³ For an account of the different sorts of cultivated oats, see *The Agriculturist's Manual*, by Peter Lawson and Son, 1836; and *Supplement*, 1842. Also, Loudon's *Encyclopædia of Agriculture*.

⁴ Quoted by L. Guélin, *Handb. d. Chemie*, Bd. ii. S. 1345.

⁵ *Précis de Chimie Industr.* 1849.

skin diseases, but without just grounds. Oatmeal porridge, taken at breakfast, sometimes relieves habitual constipation.

Intestinal concretions, composed of phosphate of lime, agglutinating animal matter, and the small, stiff, silky bristles seen at one end of the inner integument of the oat, are sometimes formed in those who habitually employ oats as food: forty-one specimens, collected by Dr. Monro secundus, are still in the Anatomical Museum of the University of Edinburgh. These formations are now comparatively rare, probably because the oats are more perfectly deprived of their investing membranes before being ground (Christison).

USES.—The oat is employed dietetically and medicinally.

As a dietetical agent, it is employed in the form of *oat-cake* or *unfermented oat-bread*, *oatmeal porridge* or *stir-about*, and *gruel*. The latter is sometimes given to infants as a substitute for the mother's milk. When there is a tendency to diarrhœa, either in adults or infants, it is advisable to substitute wheatmeal for oatmeal.

In medicine we employ *gruel*, prepared from groats or oatmeal, as a mild, nutritious, and, in most cases, easily-digested article of food in fevers and inflammatory affections. It is also in general use after parturition; and is the basis of *caudle*. In poisoning by acrid substances, it is employed as an emollient and demulcent. It is given, after the use of purgatives, to render them more efficient and less injurious. It is frequently used, either alone or in conjunction with other agents, as a clyster. *Oatmeal* is used for making poultices.

Oats are also employed by distillers for the production of spirit (see *Alcohol*).

DECOCTUM AVENÆ; *Oatmeal Gruel*; *Water Gruel*.—This is usually prepared by boiling oatmeal or groats in water for about half an hour, and then straining. Dr. Cullen¹ directs it to be prepared by boiling an ounce of oatmeal with three quarts of water to a quart, constantly stirring; strain, and when cold decant the clear liquid from the sediment. Sugar, acids, or aromatics may be employed for flavouring.

TRIBE IV. HORDEACEÆ.

35. *Lolium temulentum*, Linn.—Bearded Darnel.

Sex. Syst. Triandria, Digynia.
(Semina.)

SYNONYMES.—*Αἶρα*, Dios. lib. ii. cap. 122; Galen, de simpl. med. fac. lib. vi. § 10, and de aliment. facult. lib. i. cap. 37; Paulus Æg. lib. vii. sect. iii.; *Lolium*, Pliny, Hist. Nat. lib. xxii. cap. 79; *Lolium infelix*, Virgil, Georg. i. 153.

HISTORY.—This grass was used medicinally by the ancient Greeks and Romans, though it is somewhat remarkable that it is mentioned neither by Hippocrates nor Celsus.

BOTANY. Gen. Char.—*Spikes* many-flowered, distichous, sessile, contrary to the rachis. *Flowers* beardless at the base. *Glumes* 2, nearly equal, herbaceous, lanceolate, channelled, awnless; the lower or inner ones very often deficient in the lateral spikelets. *Paleæ* 2, herbaceous; the lower concave, awnless, or awned below the point; the upper bicarinate. *Stamens* 3. *Ovary* smooth; *styles* 2, very short, inserted below the point; *stigmas* feathery, with long, simple, finely-toothed, transparent hairs; *scales* 2, fleshy, smooth, acute, entire or two-lobed. *Caryopsis* smooth, adhering to the upper paleæ (Kunth).

Sp. Char.—*Spikelets* about 6-flowered, equalling or shorter than the glume. *Outer palea* as long as its awn.—*Root* without barren shoots. *Stem* erect, 2 feet high, smooth and shining below, rough upwards. *Ligule* short. *Inner glume* usually present, often bifid.

Lolium temulentum, *β. arvense*, (Babington, Brit. Bot.) is a variety of the above. It is usually smaller and smoother; its spikelets 4- or 5-flowered; its awns either absent or at most short, lax, and weak.

Europe (indigenous), Japan, New Holland, Chili, Monte Video.—Annual.—Fl. July.

DESCRIPTION.—The grain (*caryopsis*) enclosed in the husk is ovato-oblong, on one side flattened and furrowed—on the other convex, grayish brown; odourless, with a sweetish-bitterish, not disagreeable, taste. It yields a darkish meal or farina (called *arina* by Pliny).²

¹ *Treatise of the Materia Medica*, p. 280.

² *Hist. Nat. lib. xxii. cap. 58.*

Fig. 203.



Lolium temulentum, or Bearded
Darnel.

COMPOSITION.—In 1827, Bizio¹ examined darnel, and discovered in the seeds two peculiar substances, which he called respectively *glajalico* and *lalico*: the latter he stated possessed a narcotic power similar to that of opium. In 1837, Muratori² analyzed darnel seeds, and ascribed their poisonous properties to a peculiar acid. In 1834, Bley³ examined them, and obtained the following substances: Traces of volatile oil, chlorophyll 7.5, soft resin 3.5, bitter extractive with chlorides and sulphates 6.0, gum with chloride of calcium 6.0, sugar 0.7, albumen 0.65, extractive with malate of lime 1.55, gum with sulphate and muriate of potash 2.5, gum with malate of potash 3.0, starch 29.9, artificial gum and coagulated albumen 2.9, gluten 0.8, vegetable fibre 11.0, moisture 20.0 [loss 0.4?]. Bley concluded that the poisonous principle of darnel was extractable from the seeds by water. Subsequently,⁴ he procured from the watery extract of darnel seeds a peculiar substance, which he called *loliin*. 1000 grains of the seeds yielded him 294 grains of starch.

Loliin is a foliated or pulverulent dirty white substance, soluble in hot and cold water, and in hot alcohol. Its aqueous solution reddened litmus paper feebly. A tenth of a grain of loliin caused an acrid sensation in the throat, followed by an affection of the head and weakness of the whole body, which effects continued only for a short time.

CHEMICAL CHARACTERISTICS.—According to Ruspini,⁵ the presence of grains of *Lolium temulentum* in wheat-flour may be detected by digesting the suspected farina in rectified spirit. If the *Lolium* be present, the spirit immediately acquires a characteristic green tint, which gradually deepens; and the taste of the tincture is astringent, and so disagreeable that it may even excite vomiting. By evaporation it yields a green resin. But I have not succeeded in obtaining these results. By digesting bruised and coarsely powdered grains of *Lolium temulentum* in rectified spirit, the liquid had acquired in forty-eight hours a pale yellow colour and scarcely any flavour, and yielded, by spontaneous evaporation, a minute portion of yellowish residue with a saline taste.

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—The effects of bearded darnel on animals have been examined by Seeger, Burghard, Mariotti, and Hertwig; and the general results establish the poisonous action of the seeds of this grass. Vomiting was a general effect; followed by tremblings, convulsions, insensibility, and augmentation of urine and sweat.⁶

b. On Man.—The ill effects of the seeds of bearded darnel on man were known to the ancient Greeks and Romans. The symptoms which they produce are twofold: those indicating gastro-intestinal irritation—such as vomiting and colic; and those which arise from disorder of the cerebro-spinal system—such as headache, giddiness, languor, ringing in the ears, confusion of sight, dilated pupil, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. These seeds, therefore, appear to be acro-narcotic poisons. According to Seeger, one of the most certain signs of poisoning by them is trembling of the whole body. Both Burghard and Schober (quoted by Wibmer) mention death as having resulted from their use. In Cordier's cases their ill effects were directly ascertained by experiments made upon himself; but in most other cases they were the results of accidental poisoning. In general, they have arisen from the intermixture of bearded darnel seeds with other cereal grains.⁷ In a prison at Cologne, sixty per-

¹ Dierbach, *Die neueste Entd. in d. Mat. Med.* Bd. iii. S. 1139, 1847.

² Buchner's *Repert. für die Pharmacie*, 2te Reihe, Bd. xii. S. 181, 1838.

³ *Ibid.*, Bd. xlviii. S. 169, 1834.

⁴ *Ibid.*, 2te Reihe, Bd. xii. S. 175, 1838.

⁵ *Journ. de Pharm. et de Chimie*, 3me Sér. t. v. p. 297, 1844.

⁶ Wibmer, *Die Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 297, 1837.

⁷ See Christison *On Poisons*; and Wibmer, *op. supra cit.*

sons suffered from the use of a bread-meal containing a drachm and a half of *Iolium temulentum*, in six ounces of meal.¹

Regarded in a medicinal point of view, bearded darnel appears to possess sedative and anodyne properties. Fantoni² and Giacomini consider it to be a direct hyposthenic (see vol. i. p. 134) depressing the cerebral circulation and acting like aconite.

Uses.—Darnel has been recently employed in headache, in rheumatic meningitis, and in sciatica. Fantoni used it with success in the case of a widow who, at the climacteric period, was affected with giddiness, headache, and epistaxis, which had resisted various other remedies. In a case of violent rheumatic meningitis, very great benefit was obtained by its use.

ADMINISTRATION.—The dose of powdered darnel is one or two grains every four or six hours in the form of powder or pill. It may also be employed in the form either of decoction or of extract. The extract is given to the extent of half a grain or a grain in the day.

ANTIDOTES.—No specific chemical antidote is known. In the event, therefore, of a case of poisoning by darnel, our principal reliance must be on the use of evacuants and dynamical antidotes (see vol. i. p. 145). After the removal of the poison from the stomach and bowels, stimulants (such as ammonia, coffee, &c.) may be administered to relieve the depression.

36. HORDEUM DISTICHON, Linn.—TWO-ROWED OR LONG-EARED BARLEY.

Sex. Syst. Triandria, Digynia.

(Semen tunicis nudatum, L.—Decorticated Seeds, E. D.)

HISTORY.—Pliny,³ on the authority of Menander, says barley (*hordeum*) was a most ancient aliment of mankind. It was cultivated in Egypt nearly 1500 years before Christ.⁴ Hippocrates mentions three kinds of *αριθή* or barley; namely, barley simply so called,⁵ three-month barley,⁶ and Achilles barley.⁷ These probably were *H. vulgare*, *H. distichon*, *H. hexastichon*.

BOTANY. Gen. Char.—*Spikelets* three together, the lateral ones usually withered, two-flowered, with an upper flower reduced to a subulate rudiment. *Glumes* two, lanceolate-linear, with subulate awns, flattish, unequal sided, at right angles [*contrariæ*], with the paleæ almost unilateral, turned inwards [*anticæ*], herbaceous, rigid. *Paleæ* two, herbaceous; the inferior one (turned inwards) concave, ending in an awn; the superior one (turned outward) contiguous to the rachis, bicarinate. *Stamina* three. *Ovarium* hairy at the apex. *Stigmata* two, sessile, somewhat terminal, feathery. *Scales* two, entire or augmented by a lateral lobe, usually hairy or ciliated. *Caryopsis* hairy at the point, oblong, with a longitudinal furrow internally, adherent to the paleæ, rarely free (*Kunth*).

Sp. Char.—The lateral *florets* male, awnless; the hermaphrodite ones distichous, close pressed to the stem, awned (*Kunth*).

β. With naked seeds; *H. nudum*; *Naked two-rowed Barley*.—The grains of this variety separate from the paleæ or chaff-like wheat.

Hab.—A native of Tartary, cultivated in this country.

Several sorts of this species are in cultivation: such as the *common two-rowed* or *English barley*, the *Chevalier barley*, the *Annat barley*, *Dunlop barley*, *golden* or *Italian barley*, and *black two rowed barley* (*Hordeum distichon nigrum*).

Besides *H. distichon*, several other species of *Hordeum* are in cultivation—namely, *H. vulgare*, or *Spring Barley*; *H. hexastichon*, or *Six-rowed Barley*; and *H. Zeocitron*, *Sprat* or *Battledore Barley*.

DESCRIPTION.—The grains (*caryopsides* vel *semina hordei cruda*) are too well known to need description. As found in commerce, they are usually enclosed in the paleæ or husk. Deprived of their husk by a mill, they form *Scotch, hulled*, or *pot barley* (*hordeum mundatum*). When all the integuments of the grains are removed, and the seeds are rounded and polished, they constitute *pearl barley* (*hor-*

¹ Wibmer, p. 236.

² *Annali universali di Medicina*, Sept. 1843 (quoted by Dierbach).

³ *Hist. Nat.* xviii. 14.

⁴ *De victus rat.* lib. ii. p. 355, ed. Fossii.

⁵ *De morbis*, lib. iii. p. 496.

⁶ *Erodis*, ix. 31.

⁷ *De morb. mul.* lib. i. p. 609.

deum perlatum). The farina (*farina hordei*) obtained by grinding pearl barley to powder is called *patent barley*.

Fig. 204.



Hordeum or Barley.

a, *H. vulgare*. b, *H. hexastichon*. c, *H. distichon*. d, *H. Zeocitron*.

Three qualities of barley are distinguished in the market: the hard and flinty, fit for making pot barley; a softer kind, called malting barley, which is next in value; and feeding barley, which is adapted for neither of the uses of the two other kinds.

COMPOSITION.—According to Einhof,¹ barley has the following composition:—

The Ripe Seeds.		Barley-meal.	
Meal	70.05	Starch	67.12
Husk	18.75	Fibrous matter (gluten, starch, and lignin)	7.29
Moisture	11.20	Gum	4.62
	100.00	Sugar	5.21
		Gluten	3.52
		Albumen	1.15
		Phosphate of lime with albumen	0.21
		Moisture	9.37
		Loss	1.42
			100.00

Payen's analysis of barley has been already given (see *ante*, p. 106), as also the proportion of starch and proteine constituents according to Krockner and Horsford (see vol. i. p. 116). Mr. Johnston² gives the following as the average composition of fine barley-meal: *Starch* 68; *gluten, albumen, &c.* 14; *fatty matter* 2; *saline matter or ash* 2; *water* 14=100.

1. **PROTEINE COMPOUNDS.**—The proportion of proteine matter in barley is much less than that in wheat, and its quality is very different. If barley dough be washed with water, nearly the whole is washed away, the husk alone excepted: it contains, therefore, little or no gluten properly so called. The milky liquid deposits starchy matter and an insoluble proteine matter (insoluble caseine?), while the clear liquid holds in solution a small quantity of albumen (coagulable by heat), and of caseine (precipitable by acetic acid). If the starchy deposit be digested with water containing ammonia, a solution of the proteine compound is obtained, from which a voluminous precipitate (caseine?) is thrown down by acetic acid. (Johnston.)

2. **STARCH.**—Barley starch, like wheat starch, consists principally of large and small grains, with but few of intermediate size: but the diameter of the largest grains is somewhat larger than that of the corresponding grains of wheat starch.³ The shape of the larger grains is irregularly circular, or elliptical, or obscurely triangular, flattened or lenticular, the flattened surfaces being undulated or uneven: the smaller grains are globular, ellipsoidal, rarely angular or mullat-

¹ L. Gmelin's *Handb. d. Chemie*, ii. 1344.

² *Lect. on Agricultural Chemistry*, p. 881, 2d edit. 1847.

³ The following measurements of seven (including the largest and smallest) grains of barley starch were made by Mr. George Jackson:—

1. 0.0011 of an English inch.	5. 0.0005 of an English inch.
2. 0.0010 " "	6. 0.0002 " "
3. 0.0009 " "	7. 0.0001 " "
4. 0.0008 " "	

shaped. The hilum is scarcely, if at all, perceptible on the larger grains, and the rings are very faintly indicated: in these respects the grains of barley starch differ remarkably from those of rye starch. On the smaller grains, a hilum, or what appears to be such, is frequently perceptible. By polarized light the cross is less distinctly seen than in rye starch. Barley starch offers more resistance to the action of boiling water than some other starches; and the insoluble residue, after the prolonged ebullition of it in water, constitutes what Proust¹ called *hordeine*.

3. FATTY OR OILY MATTER.—Fourcroy and Vauquelin² detected a yellow, acrid, saponifiable, butyaceous oil, in barley.

CHEMICAL CHARACTERISTICS.—Iodine forms the blue iodide of starch, when added to the cold decoction of barley. Decoction of whole barley has an acrid bitter taste, which it derives from the husk.

PHYSIOLOGICAL EFFECTS.—Barley is a valuable nutritive. Considered in relation to wheat, it offers several peculiarities. In the first place it contains much less proteine matter; in other words, less of the flesh-and-blood-making principles; though Count Rumford³ considered barley-meal in soup three or four times as nutritive as wheat-flour. Secondly, its starch offers more resistance to the action of the gastric juice, in consequence of its more difficult solubility in water. Thirdly, its husk is slightly acrid; and, therefore, this should be removed from barley intended for dietetical purposes, as in Scotch and pearl barley. Fourthly, barley-meal is more laxative than wheat-meal.

USES.—Barley is employed both dietetically and medicinally; as well also in the brewery and distillery.

Barley-meal is sometimes added to three times its weight of wheat-meal to form infant's food; the addition of the barley-meal being intended to obviate the constipating effects of wheat-meal.

Scotch and *pearl barley* are employed to thicken soups, and to yield barley water. It is frequently used in the dietaries of pauper establishments; but when bowel complaints prevail, some other cereal grain (wheat, for example) should be substituted for it.

1. DECOCTUM HORDEI, L. D. [U. S.]; *Aqua hordeata*; *Barley Water*.—(Barley [pearl barley] \mathfrak{z} iiss [\mathfrak{z} iiss, D.]; Water Oivss [Oiss, D. (Barley \mathfrak{z} ij; Water Oivss, U. S.).]—First wash away, with water, any foreign matters adhering to the barley seeds; then, half a pint of the water being poured on them, boil the seeds a little while. This water being thrown away, pour the remainder of the water, first made hot, on them, and boil down to two pints, and strain, L.—This is a valuable demulcent and emollient drink for the invalid in febrile cases and inflammatory disorders, especially of the chest and urinary organs. It is sometimes given to children as a slight laxative. It is usually flavoured with sugar, and frequently with some slices of lemon. It is a constituent of the *Enema Aloes*, L., *Enema Terebinthinæ*, L., and *Decoction Hordei compositum*, L.

The MUCILAGO HORDEI, Ph. D., is prepared with Ground Pearl Barley \mathfrak{z} ss; Water f \mathfrak{z} xvj.

2. DECOCTUM HORDEI COMPOSITUM, L.; *Mistura Hordei*, E.; *Decoction Pectorale*; *Compound Decoction of Barley*; *Pectoral Decoction*.—(Decoction of Barley Oij; Figs, sliced, \mathfrak{z} iiss; Liquorice [root] sliced and bruised \mathfrak{z} v; Raisins [stoned] \mathfrak{z} iiss [and Distilled Water Oj, L.]. Boil down to two pints, and strain.—The process of the *Edinburgh Pharmacopœia* is essentially the same.)—This decoction is emollient, demulcent, and slightly aperient. It is employed in the same cases as the simple decoction.

3. BYNE ($\beta\acute{\epsilon}\nu\eta$); *Brasium*; *Maltum*; *Malt*.—This is barley which has been made to germinate by moisture and warmth, and afterwards dried, by which the vitality of the seed is destroyed.—By this process part of the proteine matter of the barley is converted into *diastase*. This, although it does not constitute more than about

¹ Ann. Chim. Phys. v. 339.

² Essay on Feeding the Poor, 1800.

³ Ann. de Mus. d'Hist. Nat. No. xxxvii. p. 8.

$\frac{1}{50}$ th of the malt, serves to effect the conversion of about 40 per cent. of the starch of the seed into *grape-sugar*, or *gum* (dextrine). The grain loses by the operation of malting about 8 per cent. of its weight, and gains about $\frac{1}{11}$ th or $\frac{1}{12}$ th in bulk. This loss arises in part from the separation of the radicles in the form of malt-dust or cummins. The colour of the malt varies with the temperature at which it is dried. If the temperature does not exceed 100° F., the result is *pale malt*; if it be above this and does not exceed 180°, the result is *amber malt*. These varieties of malt yield fermentable infusions. *Brown* or *blown malt* dried at 260° F. is used to communicate flavour; while *roasted, burned, or high-dried malt*, which has been scorched, is employed for colouring porter.

The *infusion of malt* (*infusum bynes*), commonly called *sweet-wort*, contains saccharine matter, starch, glutinous matter, and mucilage. It is nutritious and laxative, and has been used as an antiscorbutic and tonic. Macbride¹ recommended it in scurvy;² but it is apt to increase the diarrhœa. As a tonic it has been used in scrofulous affections, purulent discharges, as from the kidneys, lungs, &c., and in pulmonary consumption.³ The *decoction* (*decoctum bynes*) is prepared by boiling three ounces of malt in a quart of water. This quantity may be taken daily.

4. **CERVISIA;**⁴ *Ale and Beer*.—By the fermentation of an infusion of malt and hops are obtained ale and beer. These liquids consist of *alcohol, sugar, mucilage, an extractive and bitter principle, fatty matter, aroma (volatile oil?), glutinous matter, lactic and carbonic acids, salts, and water*. Common beer contains about 1 per cent., strong ale or beer about 4 per cent., best brown stout 6 per cent., and the strongest ale about 8 per cent. of spirit of sp. gr. 0.825. The ashes of beer consist of potash, soda, lime, chlorine, sulphuric acid, phosphoric acid, and silica.⁵

Beer is a thirst-quenching, refreshing, exhilarating, intoxicating, and slightly nutritious beverage.⁶

a. *Ale*⁷ is prepared with pale malt. It is, therefore, lighter coloured; and, when made with an equal weight of malt, is richer in alcohol, sugar, and gum, than porter or stout. *Pale* or *bitter ale*, brewed for the India market, has been carefully fermented so as to be devoid of saccharine matter, and contains an extra quantity of the active principles of hops. It is frequently used as a restorative beverage for invalids and convalescents.

β. *Porter* (the stronger kinds of which are called *stout*) owes its dark colour to high-dried or charred malt. When fresh or new, it is said to be *mild*; and, when old and acid, is called *hard*. An extract of *coccus indicus*, called *black extract* or *hard mullum*, is occasionally used by dishonest dealers to augment its intoxicating quality. For medicinal purposes *bottled porter* (*cervisia lagenaria*) is usually preferred to draught porter. It is used as a restorative in the latter stages of fever, and to support the powers of the system after surgical operations, severe accidents, &c.

¹ *Hist. Account of a new Method of Treating Scurvy*, 1767.

² See also a paper by Dr. Badenoeh, *Med. Obs. and Inq.* vol. v. p. 61.

³ Rush, *Med. Observ. and Inq.* iv. 367.

⁴ Pliny (*Hist. Nat. lib. xxii. cap. 82, ed. Valp.*), in noticing the drinks prepared from corn, says that "*Zythum* is made in Egypt, *celia* and *ceria* in Spain, and *cervisia*, and many more sorts, in Gaul." For *cervisia*, some writers use the term *cerevisia*. *Zythum* (Ζύθος) was a kind of beer obtained by fermentation from barley. (See Herodotus, lib. ii. cap. 77.) As *cervisia* was made from unmalting barley, its colour would be pale, and it would, therefore, in this respect, agree with our ale. But the ale and beer of the present day differ from the ancient *cervisia* in being flavoured with hops, and hence the phrase *cervisia lupulata*, which is sometimes applied to them.

⁵ Dickson, *Phil. Mag. and Journal of Science*, vol. xxxiii. p. 341, 1848.

⁶ For further details respecting the nutritive and dietetical properties of beer, see the author's *Treatise on Diet*, p. 415, et seq.

⁷ *Ale*, in Saxon *eale* or *ealo* (probably from the word *celia*, before mentioned), is sometimes Latinized, *ala* or *alla*.

37. TRITICUM VULGARE, Kunth.—COMMON WHEAT.

Sex. Syst. Triandria, Digynia.

(Farina; farina seminis: Amylum; seminis, fæcula, L.: Amylum; fæcula of the seeds, E.: The seeds, from which are prepared flour and starch, D.)

HISTORY.—In the earlier ages wheat was an esteemed article of food,¹ and is frequently spoken of by Hippocrates,² who calls it *πυρός*, and mentions three kinds of it: wheat, simply so called, three-month wheat, and Sitanian wheat. Pliny³ describes several kinds of *triticum*.

BOTANY. **Gen. Char.**—*Spikelets* three or many flowered: the fructiferous rachis generally articulated, flowers distichous. *Glumes* two, nearly opposite, almost equal, awnless or awned: the upper one bicarinate; the keels more or less aculeato-ciliate. *Stamina* three. *Ovarium* pyriform, hairy at the apex. *Stigmata* two, terminal, sessile, feathery; with long, simple, finely-toothed hairs. *Scales* two, generally entire and ciliated. *Caryopsis* externally convex, internally concave, and marked by a deep furrow, distinct, or adhering to the paleæ (Kunth).

Sp. Char.—*Spike* four-cornered, imbricated; with a tough rachis. *Spikelets* generally four-flowered. *Glumes* ventricose, ovate, truncate, mucronate, compressed below the apex, round, and convex at the back, with a prominent nerve. *Flowers* awned or awnless. *Grains* loose (Kunth).

α. æstivum,⁴ Kunth; *T. æstivum*, Linn. D.; *Spring* or *Summer Wheat*.—Annual; glumes awned.—This variety includes a great many sorts known to farmers by different names, and which may be arranged in two divisions—viz., the *white bearded* and the *red bearded*.

β. hybernum,⁴ Kunth; *T. hybernum*, Linn.; *T. compactum*, Host.; *T. velutinum*, Schnebl.; *T. crinaceum*, Hort. Hal.; *Winter Wheat*.—Biennial; glumes almost awnless. This variety also includes many sorts, which may be arranged in two divisions—viz., the *white beardless* and the *red beardless*.—Talavera wheat is a white beardless winter wheat. Mr. Hard, miller, of Dartford, tells me that “this kind (Talavera wheat) is far superior to any description of wheat, either foreign or English; and the great advantage it possesses consists in its strength, colour, and sweetness. The reason of there being so small a quantity at market, arises from the fact of its being so

Fig. 205.



Triticum.—Wheat.

- a.* *T. vulgare, α. æstivum.*
b. *T. vulgare, β. hybernum.*
c. *T. turgidum (compositum).*
d. *T. turgidum.*

- e.* *T. polonicum.*
f. *T. spelta.*
g. *T. monococcum.*

¹ Levit. ii.² Hist. Nat. xviii. 12.

³ The distinction of wheats into *summer* and *winter* wheats, or into those sown in the spring and those sown in the autumn, has been objected to on the ground that under the name of *T. hybernum* are included several of the earlier sorts of spring wheat, and under *T. æstivum*, are included several wheats which require as long a time to arrive at maturity as the common winter sorts.

⁴ De victus rat. lib. iii. p. 374, ed. Fœsli.

unprofitable to the farmer, scarcely producing one crop in three, which I greatly regret, as it is the most valuable grain we have; and, technically speaking, if the flour is properly manufactured, 8 oz. will absorb as much liquor as 11 oz. of that used by the baker."

Hab.—It is a native of the country of the Baschkirs, and is cultivated in Europe.

Besides *T. vulgare*, other species of *Triticum* are cultivated. The following are the chief:—

T. TURGIDUM, Kunth; *Turgid Wheat*. Some of the sorts of this species have smooth ears; others downy, woolly, or velvety ears.—This species includes the *T. turgidum*, Linn. and *T. compositum*, Linn.

T. DURUM, Kunth; *Hard or Horny Wheat*.

T. POLONICUM, Kunth; *Polish Wheat*.

T. SPELTA, Kunth; *Spelt Wheat*.

T. MONOCOCCUM, Kunth; *One-grained Wheat*.

DESCRIPTION.—Wheat-grains (*caryopsides tritici*; *semina tritici*), as brought to market, are completely devoid of their paleæ (*chaff* or *husk*).

The number of parts into which millers separate wheat varies in different localities. According to Mr. Hard, miller, of Dartford, in Kent, the products obtained by grinding one quarter or eight bushels of wheat are as follows:—

PRODUCE OF ONE QUARTER OF WHEAT WEIGHING 504 lbs.

Flour	392 lbs.
Biscuit or fine middlings	10
Toppings or specks	3
Best pollard, Turkey pollard, or twenty-penny	15
Fine pollard	18
Bran and coarse pollard	50
Loss sustained by evaporation, and waste in grinding, dressing, &c.	11
	<hr/> 504 lbs.

Wheat-grains vary in size, smoothness, transparency, and hardness, and in the thickness of their integuments; and, consequently, the relative proportions of bran (and pollard) and flour which they yield vary. The integument readily separates in soft-grained wheat, but with difficulty in the hard-grained: the former, therefore, yields more bran and less flour; while the latter produces flour of a lower quality, because it is intermixed with some of the ground integuments.

Semolina, *Soujee*, and *Manna Croup*¹ are granular preparations of wheat, deprived of bran.

I am indebted to Mr. Hard for the following notice (as well as for samples) of the products obtained in grinding wheat:—

"The wheat having been ground in the usual way, should be allowed to remain in the meal for some time before dressing, which removes the heat caused by the process, and enables the miller to obtain more flour, and the baker a better quality, than if dressed immediately it is ground.

"The process of dressing is by a wire cylinder containing a certain number of sheets of different texture or fineness, which cylinder contains eight hair-brushes attached to a spindle passed through the centre of the cylinder, and laid out so as to gently touch the wire: this cylinder is fed by a shoe with the meal; then the flour and offal, after passing through the wire in this way, are divided by wood partitions fixed close to the outside of the cylinder. The produce of wheat-meal dressed through the wire machine consists of—1st, *Flour*; 2d, *White Stuff*, or *Boxings*, or *Sharps*; 3d, *Fine Pollard*; 4th, *Coarse Pollard*, or *Horse Pollard*; 5th, *Bran*. The second product (*i. e.* the *White Stuff*) is then submitted to another dressing through a fine cloth machine, and produces—1st, *Fine Middlings*, for *Biscuits*; 2d, *Toppings* or *Specks*; 3d, *Dustings*; 4th, *Best Pollard*, *Turkey Middlings* or *Coarse Middlings*.

COMPOSITION.—1. *Wheat-flour* has been analyzed by Vogel,² by Proust,³ by Henry,⁴ and by Vauquelin.⁵ The following are the results obtained by Vauquelin.

¹ The term *Manna Croup* is probably derived from *Manna-Grout*, the name of a nutritious food prepared from the grain of *Glyceria fluitans*. (See Curtis, *Fl. Lond.* vol. i. pl. 7; also, Tooke's *View of the Russian Empire*, vol. iii. p. 168, 2d edit. 1800.)

² Quoted by L. Guerin. *Handb. d. Chem.* Bd. ii. S. 1341.

⁴ *Journ. de Pharm.* t. viii. p. 31, 1822; and t. xv. p. 127, 1829.

³ *Ann. Chim. Phys.* t. v. p. 340.

⁵ *Ibid.*, t. viii. p. 353, 1822.

COMPOSITION OF WHEAT FLOUR.

	French Wheat.	Odessa Hard Wheat.	Odessa Soft Wheat.	Ditto.	Ditto.	Flour of Paris, bakers.	Ditto of good quality used in public establishments.	Ditto, inferior kind.
Starch	71.49	56.5	62.00	70.84	72.00	72.8	71.2	67.78
Gluten	10.96	14.55	12.00	12.10	7.30	10.2	10.3	9.02
Sugar	4.72	8.48	7.56	4.90	5.42	4.2	4.8	4.80
Gum	3.32	4.90	5.80	4.60	3.30	2.8	3.6	4.60
Bran	—	2.30	1.20	—	—	—	—	2.00
Water	10.00	12.00	10.00	8.00	12.00	10.0	8.0	12.00
Wheat flour . .	100.49	98.73	98.56	100.44	100.02	100.0	97.9	100.20

Payen's analysis of wheat has been already given (see *ante*, p. 106); as also the proportions of water, proteine matters, and starch, according to the investigations of Horsford and Krockner (see vol. i. p. 116); and the composition of the ash of wheat (see *ante*, p. 106).

Mr. Johnston¹ found that in 20 samples of English flour the proportion of water varied from 15 to 17 per cent.

The proportion of the organic constituents of wheat is liable to considerable variation, according to soil, climate, variety of seed, mode of culture, time of cutting, and quality of manure.

2. The composition of *bran*, like that of wheat-flour, is subject to great variation; but the following is given by Mr. Johnston as the average:—

COMPOSITION OF BRAN.

Water	13.1
Albumen (coagulated)	19.3
Oil	4.7
Husk and a little starch	55.6
Saline matter (ash)	7.3

Bran 100.0

1. **STARCH**—As wheat-starch is an article of the *materia medica*, it will be noticed among the official preparations (see *ante*, p. 124).

2. **PROTEINE MATTERS**.—The quantity of proteine matters in wheat has been already stated (see vol. i. p. 116, and vol. ii. p. 123). Wheat contains at least four different proteine compounds, namely, *albumen*, *vegetable*, *fibrine*, *gluten*, and *caseine*. They have an analogous composition, and contain each about 16 per cent. of nitrogen.

If wheaten-dough be washed on a sieve by a stream of water, a milky liquid passes through, and a tenacious elastic mass is left behind called *crude gluten*, or sometimes *Beccaria's gluten*. The milky liquid holds in solution gum, sugar, and albumen; and in suspension starch: the crude gluten contains vegetable fibrine, gluten, caseine or mucine, and oil. According to Saussure² crude gluten has the following composition:—

Gluten	20
Vegetable fibrine	72
Mucine (caseine?)	4
Oil	3.7
Starch (accidental)	a small quantity

Crude gluten 99.7

a. Vegetable Albumen.—Obtained by allowing the milky liquid above mentioned to deposit its starch, and then heating the supernatant liquor nearly to boiling: flakes of coagulated albumen are formed. Its composition was found by Dr. Bence Jones³ to be carbon 55.01, hydrogen 7.23, nitrogen 15.92, oxygen, sulphur, and phosphorus 21.84.

b. Gluten; Gliadine (from *γλία*, glue); *Pure Gluten*.—Obtained by boiling crude gluten in alcohol, which extracts gluten, caseine or mucine, and oil. By cooling, the caseine is deposited. The supernatant liquid is then evaporated to dryness, and the adhesive mass thus obtained digested with ether to extract the oil: the residue is gluten. Its composition has been before noticed (see vol. i. p. 112).

γ. Vegetable Fibrine; Zymome (from *ζύμω*, ferment).—This is the part of crude gluten which is insoluble in alcohol. Mulder considers it to be coagulated albumen; Liebig as vegetable fibrine. Johnston, on the other hand, thinks it different from both albumen and fibrine, and,

¹ *Lectures on Agricultural Chemistry*, 2d edit. p. 867.

² *Bibliothèque universelle*, Sciences et Arts, t. liii. p. 260, 1833.

³ Liebig's *Animal Chemistry*.

therefore, calls it simply gluten. When obtained as above described it much resembles the fibre of lean beef. Dr. Bence Jones ascertained its composition to be carbon 55.22, hydrogen 7.42, nitrogen 15.98, oxygen, &c., 21.38.

8. *Casine*.—After the albumen has been separated by heat from the aqueous liquid before alluded to, the addition of acetic acid causes the separation of what is supposed to be casine. The white flocculent substance, which deposits on cooling from the alcoholic liquor in which crude gluten has been boiled, and which has been called *micine*, somewhat resembles casine.

3. *OIL*.—Obtained by digesting wheat flour in ether. The quantity procured varies from $1\frac{1}{2}$ to 3 per cent. As bran yields about twice as much as fine flour, it follows that the oil exists in greater proportion in the outer than in the inner part of the grain. The oil resembles the fatty oils or butter in its properties. By washing wheat-dough, part of the oil is washed out, and part remains in the crude gluten.

4. *WATER*.—According to Johnstone, English flour contains, on an average, from 15 to 17 per cent. of water.

5. *MINERAL CONSTITUENTS*.—The composition of the ashes of wheat has been already stated (see *ante*, p. 106). The most important of these constituents are the alkaline and earthy phosphates.

CHEMICAL CHARACTERISTICS.—The cold decoction of wheat-flour forms, with tincture of iodine, the blue iodide of starch. Nitric acid gives wheat-flour a fine orange-yellow colour. Recently-prepared tincture of guaiacum forms a blue colour with good wheat-flour.

DISEASES OF WHEAT.—Five diseases of wheat are produced by the attacks of parasitic fungi; namely, 1st, *bunt*, *smut-balls*, or *pepper-brand*, produced by *Uredo Caries*, De Candolle; 2dly, *smut*, *dust-brand*, or *burnt-ear*, produced by *Uredo segetum*; 3dly, *rust*, *red-rag*, *red-robin*, or *red-gum*, caused, as Professor Henslow has shown, by the young state of *Puccinia graminis*, which was formerly supposed to form two distinct fungi, to which the names of *Uredo Rubigo* and *U. linearis* had been given; 4thly, *mildew*, produced by the *Puccinia graminis* in a more advanced period of its growth; and 5thly, *ergot*, caused by the *Oidium abortifaciens* (see *ante*, p. 87).

Two diseases of wheat are produced by parasitic animalcules; namely, first, the *ear-cockle*, *purples*, or *peppercorn*, caused by a microscopic, eel-shaped animalcule, called *Vibrio Tritici*; and, secondly, the *wheat-midge*, an abortion of the grain caused by a minute two-winged fly called *Cecidomyia Tritici*.

Corn affected with any of these diseases is of course deteriorated in value; but we have still to learn what are the precise effects on the animal economy of grain thus infected. The *bunt* imparts to flour its disgusting odour, and makes it less fit for bread; but flour thus tainted is used in the manufacture of ginger-bread. *Smut* does not give any unpleasant odour to corn, which, when infected with it, is frequently used for feeding fowls, apparently without producing any ill effects. I have ascertained that *ergot of wheat* is as powerful in its action on the uterus as ergot of rye. It has been suggested that some remarkable cases of spontaneous gangrene which occurred at Wattisham, in Suffolk, in 1762, may possibly have arisen from the presence of ergot in the corn used by the persons affected; but of this there is no evidence.

DETERIORATION; ADULTERATION.—By exposure to a damp air, wheat-flour absorbs moisture, and, after some time, acquires a musty odour, and becomes mouldy; the gluten being the first to suffer change. In this state it may be readily conceived that wheat-flour would prove injurious to health.

Wheat-flour is subject to adulteration with various vegetable and mineral substances.

Among vegetable substances used for the purpose of adulterating wheat-flour, the following have been named: potato starch, the meal of other cereal grains (viz., of maize, rice, barley, and rye), of buckwheat, and of certain leguminous seeds (viz., of beans, peas, and vetch).

In the detection of these adulterations, the microscope lends important assistance.

¹ For an excellent account of the diseases of wheat, see the Rev. Professor Henslow's *Report* on this subject, in the *Journal of the Royal Agricultural Society of England*, 1811, vol. ii. part 1.

It enables us to judge of the size and shape, the markings on, and the isolation and agglomeration of, the starch grains, and thereby to distinguish the starch grains of one meal from those of another.

In some cases, the microscopic examination of suspected flour is aided by the use of a solution of potash. Thus it enables us readily to detect the presence of either potato starch or the meal of leguminous seeds. If a solution containing about $1\frac{1}{2}$ per cent. of potash¹ be added to a mixture of potato-starch and wheat-starch (or wheat-flour), the granules of potato-starch swell up, and acquire three or four times their original volume, while those of wheat-starch are scarcely affected by it. A solution of potash, containing about 12 per cent. of potash, dissolves all the varieties of starch, but not cellulose; hence, if to wheat-flour, intermixed with the meal of some leguminous seed, this solution be added, the starch grains dissolve, and the hexagonal tissue of the adulterating leguminous seed is rendered very-obvious.²

Occasionally, polarized light may be used to aid the microscope in detecting adulterations of wheat-flour. Thus, unlike wheat-starch, the starch of the oat produces no effect on polarized light, and presents no crosses when viewed by it.

In the detection of the meal of the leguminous seeds, the odour and flavour of the suspected flour, and its chemical characters, aid in detecting the fraud. If the suspected flour be digested with twice its volume of cold water, the infusion filtered and a few drops of acetic acid added to it, a precipitate of legumine (a kind of caseine) is produced, if the meal of a leguminous seed be present;³ but wheat-flour, treated in the same way, yields a slight precipitate (of caseine), and, therefore, this test must not be relied on. Donny has pointed out a mode of detecting the meal of two leguminous seeds, viz., the vetch (*Vicia sativa*), and beans (*Faba vulgaris*, common tick bean): it consists in exposing the suspected flour to the successive action of the vapours of nitric acid and ammonia: wheat-flour, when thus treated, becomes yellow; but the meals of the leguminous seeds just referred to become red, and hence, wheat-flour adulterated with either of them becomes more or less spotted with red, according to the proportion of the leguminous meal present.

The mineral substances which have been used to adulterate wheat-flour are chiefly chalk and sulphate of lime (plaster of Paris). White clay and bone-ashes are also said to have been used. Sulphate of copper and alum are sometimes added to bad wheat-flour to improve its quality and render it more fitted for making bread. These different adulterations may be readily detected. Their quantity and nature may be judged of by incinerating the suspected flour, weighing the ash (which in genuine flour amounts to about 1 or $1\frac{1}{4}$ per cent.), and determining its nature. Flour mixed with chalk effervesces on the addition of hydrochloric acid, and yields a calcareous solution detectable by a solution of oxalate of ammonia (see vol. i. p. 568). Flour mixed with sulphate of lime, when digested in water, yields a solution which answers to the tests both for lime (see vol. i. p. 568) and for sulphuric acid (see vol. i. p. 368). Pure wheat-flour is almost completely soluble in a strong solution of potash containing about 12 per cent. of alkali; but mineral substances used for the purpose of adulteration remain undissolved.

PHYSIOLOGICAL EFFECTS.—The nutritive qualities of wheat are similar to those of the cereal grains generally, and which have been already noticed (see *ante*, p. 107).

As it exceeds other kinds of corn in the proportion of proteine matters which it contains, so it surpasses them in its flesh- and blood-making qualities. But, as it contains less starch and fatty matters than some other cereal grains, it is probably inferior to the latter as a fattening agent.

¹ I find that a mixture of 1 measure of *liquor potassæ*, Ph. L., and 2 or 3 measures of distilled water, readily distinguishes potato-starch from wheat-starch.

² Donny, *Ann. de Chim. et de Phys.* 3me Ser. t. xxi. p. 5, 1847; and *Journ. de Pharm. et de Chim.* 3me Ser. t. xii. p. 139, 1848. Also, Mareska, *Journ. de Pharm. et de Chim.* 3me Ser. t. xii. p. 98, 1847; also, *Pharmaceutical Journal*, vol. vii. p. 394, 1848.

³ *Journ. de Pharm. et de Chim.* 3me Ser. t. xi. p. 322, 1847; also, *Pharmaceutical Journal*, vol. vii. p. 84, 1847.

The different parts of the grain differ in composition, and, therefore, in nutritive value. The external sub-epidermoid part contains a larger proportion of oil, of salts (chiefly phosphates), and albuminous and caseine matter than the more internal and farinaceous portion; and it is, therefore, probable that the finest flour, which has been freed as much as possible from all traces of bran, is actually somewhat less nutritive than the coarser flour.

Wheat-flour, especially when baked, is rather constipating than purgative. In this it differs from both barley-meal and oat-meal. Infants who are fed on baked flour frequently suffer with constipation; and to relieve this it is sometimes found necessary to substitute a portion of barley-meal for an equivalent weight of wheat-flour.

Wheat-flour yields the finest, whitest, lightest, and most digestible kind of bread. It owes its superiority in these respects to the large quantity of tenacious gluten which it contains.

Undressed wheat-flour appears to act, by the bran which it contains, as a mechanical stimulant to the bowels; and hence brown bread is resorted to for the purpose of counteracting habitual constipation.

USES.—Wheat-flour is employed in medicine both as a therapeutical and a pharmaceutical agent.

It is used with great advantage as a dusting powder in burns and scalds. It cools the part, excludes the air, and absorbs the discharge, with which it forms a crust which effectually protects the subjacent part. When the crust has become detached by the accumulation of purulent matter beneath, a poultice may be applied, and, after the removal of the crust, the exposed surface may be again dusted over with flour.

A mixture of flour and water is used as a chemical antidote in poisoning by the salts of mercury, copper, zinc, silver, and tin, and by iodine (see vol. i. p. 203).

Flour is a constituent of some poultices, as the *yeast-poultice* (see *ante*, p. 86), and the *mustard-poultice*.

It is used in pharmacy for enveloping pills.

1. **AMYLUM TRITICI**; *Amylum*; *Wheat-Starch*.—This starch was known to Pliny,¹ who says the discovery of it was first made in Chios, and that it received its name *amylum* (ἀμυλον; from *a*, negative, and *μύλος*, *a mill*) because it was not prepared by grinding in a mill.

There are various modes of preparing it, but the method followed in this country is a mechanico-chemical one, the starch being separated from the other ingredients of wheat, partly by mechanical agency, and partly by chemical means. The cellulose or woody fibre of the grain is separated by mechanical means; the gum, sugar, albumen, and soluble salts, are dissolved out by cold water; and the gluten is got rid of partly by allowing it to undergo decomposition, and partly by solution in the acetic acid which is developed by fermentation.

A mixture of coarsely-grained wheat is steeped in water in a vat for one or two weeks (according to the state of the weather), by which acetous fermentation is established. The acid liquor (called *sour water*, or simply *sours*) is drawn off, and the impure starch washed on sieves to separate the bran. What passes through is received in shallow vessels termed *frames*. Here the starch is deposited. The sour liquor is again drawn off, and the *slimes* removed from the surface of the starch, which is to be again washed, strained, and allowed to deposit. The liquid which is drawn off is called *green water*. If the operation of washing be again resorted to, the part washed off is called *white water* instead of *slimes*, the liquid itself being still termed *green water*. When, by these processes, the starch has become sufficiently pure, it is *boxed*; that is, it is placed in wooden boxes perforated with holes and lined with canvas, where it drains. It is then cut in square lumps, placed on chalk stones or bricks, to absorb the moisture, and dried in a stove. By this pro-

¹ *Hist. Nat. lib. xviii. cap. 17, ed. Valp.*

cess the blocks are *crusted* (see *ante*, p. 108). The blocks are then scraped, papered, labelled, stamped, and returned to the stove. Here they split into columnar masses (like grain, tin, or basaltic columns), commonly called the *race*.

In commerce, there are two kinds of wheat-starch—one *white*, the other *blue*.

1. *White wheat-starch* is the sort which should be employed for dietetical or medicinal purposes. What is sold under the names of *French starch* and *patent white starch* is of this kind.

2. *Blue wheat-starch* is used by the laundress for stiffening linen. It owes its colour to finely-powdered smalt or indigo, which has been introduced into it before the boxing process. The *Poland* and *glaze starches* of the shops are of this kind. They are not adapted for medicinal purposes.

When examined by the microscope, wheat-starch is perceived to consist principally of large and small grains, with but few of intermediate size.¹ The smaller particles appear to be spheroidal or nearly so. The large ones are rounded, and flattened or lenticular. When at rest, they appear to be globular; but, by making them roll over in water, they are seen to be flattened, compressed, or lenticular; one of the flattened faces being sometimes a little more convex than the other. Viewed edgewise, the particles are strongly shaded. In the middle, or nearly so, of the flattened surface is the rounded, elongated, or slit hilum. This is surrounded by concentric rings, which extend frequently to the edge of the grains. When heated, the particles crack at the edges.

When heated in a tray in an oven to 300° F., wheat-starch acquires a buff colour, and is converted into dextrine or *British gum*.

Boiled in water, wheat-starch yields a *mucilage*, which, when sufficiently concentrated, forms, on cooling, a *jelly* (*hydrate of starch*). The consistence of this jelly is due to the mutual adhesion of the swollen hydrated integuments of the starch grains. When submitted to prolonged ebullition in a large quantity of water, the granule almost entirely dissolves, and the decoction, on cooling, does not gelatinize. With iodine the decoction, when cold, forms the blue iodide of starch, the colour of which is destroyed by alkalis and by heat.

The composition of wheat-starch is $C^{12}H^{10}O^{10}$.

Wheat-starch is not employed alone as food. As found in commerce, its taste is somewhat disagreeable.

Starch powder is used as a dusting powder to absorb acrid secretions and to prevent excoriation. Its decoction is used as an emollient and demulcent clyster in inflammatory conditions of the large intestines, and as a vehicle for the formation of other more active enemata. Starch is an antidote for poisoning by iodine, and is sometimes given in combination with this substance to prevent its local action (see vol. i. p. 405). It enters into the composition of the *Pulevis Tragacanthæ compo-situs*, Ph. L.

2. **DECOCTUM AMYLI**, L.; *Mucilago Amyli*, E. D.; *Decoction or Mucilage of Starch*.—(Starch \mathfrak{z} iv; Water Oj [Oss, D.].) Rub the starch with the water gradually added, then boil for a short time.—It is sometimes used alone as an enema in dysentery, irritation of the rectum, &c. It is a constituent of the *Enema Opii*, L.

3. **FURFURES TRITICI**; *Bran*.—Decoction or infusion of bran is sometimes employed as an emollient foot-bath. It is also taken internally as a demulcent in catarrhal affections. Its continued use causes a relaxed condition of bowels. Bran poult-

¹ The following measurements of the starch grains of different sizes of common and spelt wheat were made by Mr. George Jackson:—

Common Wheat.		Spelt Wheat.	
1. . . . .	.0009 of an English inch.	1. . . . .	.0012 of an English inch.
2. . . . .	.0006 " "	2. . . . .	.0010 " "
3. . . . .	.0004 " "	3. . . . .	.0005 " "
4. . . . .	.0003 " "	4. . . . .	.0003 " "
5. . . . .	.0002 " "	5. . . . .	.0001 " "
6. . . . .	.0001 " "		

tices are applied warm in abdominal inflammation, spasms, &c. *Bran bread* is used in diabetes (see p. 127, foot-note).

4. **FARINA TRITICI TOSTA**; *Baked Flour*.—Wheat-flour lightly baked, so as to acquire a pale buff tint, is an excellent food for infants, invalids, and convalescents. Unlike the more amylaceous substances (such as arrow-root, tapioca, sago, &c.), it contains flesh- and blood-making as well as fat-making ingredients. Moreover, it has no tendency to relax the bowels; on the contrary, I think it is somewhat constipating. Hence, therefore, it may be used with advantage where there is a tendency to diarrhœa. When employed as an infant's food, it may be sometimes desirable to mix it with a fourth of its weight of prepared barley-meal, to obviate its constipating effects. It is prepared by boiling it in milk or milk and water, and is taken as a kind of pottage or gruel.

Hard's Farinaceous Food is a fine wheat-flour, which has been subjected to some heating process. It is an excellent preparation.

5. **TURUNDÆ ITALICÆ**; *Macaroni, Vermicelli, and Italian or Cagliari Paste* (in the form of stars, lentils, &c.).—These are pastes made with the finest and most glutinous wheat. By the artificial addition of wheat-gluten to the ordinary wheat, products may be obtained which rival the finest Italian pastes.¹ The *granulated gluten* (*gluten granulé*) of MM. Véron frères is a paste made in this way. These various preparations are agreeable and most nourishing foods. Boiled in beef-tea, or similar fluids, they may be taken with great advantage by invalids and convalescents.

6. **PANIS TRITICEUS, L.**; *Wheaten Bread*.—This is of two kinds, fermented or leavened, and unfermented or unleavened.

a. *Panis fermentatus*; *Fermented or Leavened Bread*.—The ingredients used in its manufacture are wheat-flour, salt, water, and yeast. In making the ordinary loaf-bread of London, the baker always employs a portion of potatoes; not for adulteration, but to assist fermentation, and to render the bread lighter. Patent yeast (see *ante*, p. 85) is generally employed by him on the score of economy. The yeast excites the fermentation of the sugar, which it converts into alcohol and carbonic acid: the former is dissipated in the oven, and the latter, distending the dough, causes it to *rise*, and gives the vesicular character to bread. During the process, a portion of starch is converted into soluble gum (dextrine) and a small portion of sugar.

The following table represents the comparative composition of the flour and bread of wheat, according to Vogel:—²

<i>Flour.</i>		<i>Starch.</i>	
Starch	68.0	Starch	53.5
Sugar	2.3	Sugar	3.6
Gum	2.5	Starch-gum	18.0
Moist gluten	24.3	Gluten, with some starch	20.75
Albumen	1.5	Carbonic acid, and the muriates of lime and magnesia . . . . .	..
	99.6		95.85

Flour in baking takes up a considerable quantity of water, the absolute amount of which, however, depends on several circumstances. Home-made bread baked in separate tins contains about 44 per cent. of water, whereas the flour from which it is made contains only about 16 per cent. Ordinary bakers' bread, baked in united loaves, contains as much as 50 or 51 per cent. of water. Various additions made to wheat-flour enable it to take up more water. Common salt does this: in the language of the baker it gives stiffness or strength to the dough. Alum (used by bakers under the name of "*stuff*") has a similar effect: it also augments the whiteness and fineness of bread, and renders it less liable to crumble. It, therefore,

¹ Payen, *Précis de Chimie Industr.* p. 397, 1849.

² Quoted by Gmelin, *Handb. d. Chem.* 11d. ii. S. 1341 and 1343; also, *Journ. de Pharm.* t. iii. p. 211, 1817.

enables the baker to use an inferior flour with less chance of detection. Sulphate of copper (in the proportion of one grain to two pounds of flour) has a like effect, and has been used in some parts of Belgium to adulterate bread. It is said to enable the latter to take up 6 per cent. more water without appearing moister.¹

The general dietetical properties of bread resemble those of wheat-flour (see *ante*, p. 124). In diabetes, its use is objectionable on account of its augmenting the saccharine condition of the urine.² In some forms of dyspepsia, fermented bread disagrees with the patient; and, in such, benefit is occasionally obtained by the substitution of unfermented bread. The use of *brown bread* as a preventive of habitual costiveness has already been referred to (see *ante*, p. 124). It, however, frequently fails to produce the desired effect.

Fermented bread is employed both in medicine and pharmacy. *Crumb of bread* (*mica panis*) is sometimes used in the formation of pills; but is objectionable for this purpose, on account of the pills thus made becoming excessively hard by keeping. Furthermore, in some cases, the constituents of bread decompose the active ingredients of the pills. Thus, the chloride of sodium of bread decomposes nitrate of silver. Crumb of bread is most valuable for the preparation of poultices. The *bread-and-water-poultice* is prepared by covering some bread in a basin with hot water: after it has stood for ten minutes, pour off the excess of water, and spread the bread about one-third of an inch thick on soft linen, and apply to the affected part. Sometimes lint dipped in oil is applied beneath the poultice.³ Decoction of poppy, or Goulard's water, may be substituted for common water. This is a valuable application to phlegmonous inflammation. A *bread-and-milk-poultice*, to which lard is sometimes added, is also used to promote suppuration; but it should be frequently renewed, on account of its tendency to undergo decomposition. Both poultices are used in the treatment of irritable ulcers.

β. *Panis sine fermento*; *Panis azymus*; *Unfermented Bread*.—Of this there are two kinds; one compact and heavy, the other light and elastic.

Of the *heavy and compact* kind of unfermented bread we have an example in the common sea-biscuit or ship-bread (*panis nauticus*), which, on account of its hardness and compactness, must be more slowly permeated and acted on by the gastric juice than the ordinary light and porous fermented bread. These biscuits are frequently adulterated with chalk. Some dyspeptics prefer the lighter kinds of biscuits (*panis biscotus*) to fermented bread. *Biscuit powder* is frequently used for infants' food.

The *light and porous* kinds of unfermented bread owe their lightness and porosity to some volatile or gaseous body developed in the dough by either heat or chemical action. In the preparation of certain kinds of biscuits, solid sesquicarbonate of ammonia is used to produce lightness. The heat of the oven volatilizes the salt, the vapour of which distends the dough. Carbonic acid (developed by the action of an acid on an alkaline carbonate) is, however, the agent generally employed to give porosity to unfermented bread. The *patent unfermented bread* is a preparation of this kind. The following receipt yields an excellent product: Take of

¹ For further details respecting the chemistry of fermented bread, the reader is referred to Dumas, *Traité de Chimie appliquée aux Arts*, t. vi. 1843; Johnston's *Lectures on Agricultural Chemistry*, 2d edit. 1847; and Payen, *Précis de Chimie Industrielle*, 1849.

² Bouchardat (*Comptes Rendus*, Nov. 1841, p. 942) suggested the use of a *gluten-bread*, in diabetes, as a substitute for the ordinary wheat-bread, but in practice it has not been found available. When quite devoid of starch, it can be masticated only with extreme difficulty, and, in fact, is not edible.—*Bran-bread* is, perhaps, the best kind of bread for diabetic patients. Dr. Prout (*Stomach and Renal Diseases*, 5th edit., p. 44, 1848) has published a receipt for a bread of this kind devised by his patient, the late Rev. J. Rigg. The following formula yields the best product which I have seen, and has proved highly useful in one case of diabetes: Take coarse *wheat-bran*, wash it thoroughly with water on a sieve, until the water passes through clear; then dry it in an oven, and grind to a fine powder by a mill (the mill which was found to answer was made by White, in Holborn). Then take 7 eggs, 1 pint of milk, $\frac{1}{2}$ lb. of butter, a few carraways or some ginger, and make into a paste with a sufficiency of the bran-flour. Divide the mass into seven equal parts, and bake each separately, in a saucer, by rather a quick oven; the time required for baking is usually about 20 minutes.—Dr. Percy (*Chemical Gazette*, March 15, 1849) has published a receipt for a bread for diabetic patients made of the ligneous matter of potatoes (see the article *Solanum tuberosum*).

³ Abernethy, *Lancet*, vol. v. 1824, p. 135.

Flour $\mathfrak{H}\mathfrak{j}$; Bicarbonate of Soda 40 grains; Cold Water half a pint, or as much as may be sufficient; Muriatic Acid of the shops 50 drops; Powdered White Sugar a teaspoonful. Intimately mix the bicarbonate of soda and sugar with the flour, in a large basin, by means of a wooden spoon. Then gradually add the water with which the acid has been previously mixed, stirring constantly, so as to form an intimate mixture very speedily. Divide into two loaves, and immediately put them into a quick oven.—If any soda should escape the action of the acid, it causes one or more yellow spots, which, however, are more unsightly than detrimental. The sugar may be omitted if thought desirable. This kind of bread is well adapted for the use of invalids and dyspeptics. With the latter it sometimes agrees when ordinary fermented bread disagrees. It is superior to biscuits in lightness and porosity. It is a very convenient kind of bread for persons on ship-board and in other places where yeast cannot be procured.

38. SECALE CEREALE, Linn.—COMMON RYE.

Sex. Syst. Triandria, Digynia.
(Semina, Offic.)

HISTORY.—Rye is mentioned in the English version of the Old Testament;¹ but, in the opinion of Sprengel,³ spelt wheat is meant. The same writer also states that Theophrastus⁴ is the earliest author who notices the *Secale cereale*; but the word $\tau\acute{\iota}\phi\eta$, used by Theophrastus, is thought by Fraas⁵ to refer to *Triticum monococcum*, and not to rye. Galen⁶ mentions rye under the name of $\beta\rho\acute{\iota}\varsigma\alpha$, the term by which, as well as by $\sigma\iota\kappa\alpha\lambda\iota$, rye is known in modern Greece.⁷ Pliny⁸ speaks of *secale* or rye.

BOTANY. **Gen. Char.**—*Spikelets* two-flowered. *Florets* sessile, distichous, with the linear rudiment of a third terminal one. *Glumes* two, herbaceous, keeled, nearly opposite, awnless or awned. *Paleæ* two, herbaceous; the lower one awned at the point, keeled, unequal sided, broadest and thickest on the outer side; the upper shorter and bicarinate. *Stamina* three. *Ovarium* pyriform, hairy. *Stigmata* two, nearly sessile, terminal, feathery, with long, simple, finely-toothed hairs. *Scales* two, entire, ciliate. *Caryopsis* hairy at the point, loose (*Kunth*).

Sp. Char.—*Glumes* and *awns* scabrous (*Kunth*).

Hab.—The Caucasian-Caspian desert. Cultivated in Europe; but little in England; frequently on the Continent.

DESCRIPTION.—Rye grains (*caryopsides vel semina secalis vel frumenti*), in external appearance, more resemble wheat than other cereal grains; but they are

¹ The above formula yields a bread of excellent quality, as I can vouch from having repeatedly employed it. Various other formulæ have been published, many of which doubtless also yield excellent products. The following are given in a little pamphlet entitled *Instructions for making Unfermented Bread*, by a Physician, 15th edit. 1848.—

TO MAKE WHITE OR FLOUR BREAD.

Take of Flour, dressed or household	3 lbs. avoirdupois.
Bicarbonate of soda, in powder	9 drachms, apothecaries' weight.
Hydrochloric (muriatic) acid	1½ fluidrachms.
Water	about 25 fluidounces.

TO MAKE BROWN OR MEAL BREAD.

Take of Wheat meal (that is, wheat well ground, as it comes from the mill, retaining the whole of the bran)	3 lbs. avoirdupois.
Bicarbonate of soda, in powder	10 drachms, apothecaries' weight.
Hydrochloric (muriatic) acid	12½ fluidrachms.
Water	about 28 fluidounces.

In the shops are sold powders under various names (such as *Borwick's Original German Baking Powder for making Bread without Yeast*; and *Edwards's Egg Powder*) to enable persons to prepare a light bread without yeast, or even light puddings without eggs. They are usually mixtures of *tartaric acid* and *carbonate of soda*, with some farinaceous substance (*wheat flour* and *potato starch*); to which is sometimes added a small portion of *alum*. They are very useful and convenient preparations; and, for employment on board ship, and in various other situations, will be found very valuable.

² *Erodus*, ix. 32.

⁴ *Hist. Plant. lib. viii. cap. 9.*

⁶ *De Alim. facult. lib. i. cap. xliii. tom. vi. p. 320.*

⁷ Fraas. *op. supra cit.*; also, *Pharm. Græca*, pp. 501 and 540, 1837.

⁸ *Hist. Nat. lib. xviii. cap. 39 and 40, ed. Valp.*

³ *Hist. Rei Herb. ii. 9, 1807.*

⁵ *Synops. Pl. Floræ Classicæ*, pp. 306 and 307, 1845.

smaller and darker externally. Internally they are white and farinaceous; externally brownish. Like wheat, as found in commerce, they are devoid of their husk or paleæ.

In order that the changes which rye undergoes when it becomes ergotized may be better understood, Corda¹ has given the following description of the microscopic characters of healthy rye grains: "When we submit a thin transverse section of a healthy grain of rye to microscopic examination, we perceive that the seed-coat (Fig. 207, *a*) consists of three layers of thick-walled cells, beneath which we find the second, properly the third, seed-coat (207, *b*), composed of a single layer of thick-walled cells, having scarcely any cavity. Next follows a layer of cells containing gluten (207, *c*); and afterwards the cellular tissue of the albumen (207, *d*). This consists of large roundish hexagonal cells, which contain grains of starch (Fig. 208). The starch-grains (Fig. 209) are roundish or ellipsoidal, and about the 0.000150 of the Paris line in length."

Fig. 206.



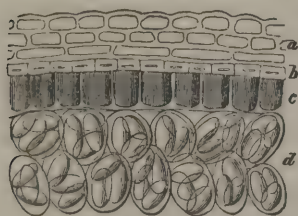
Secale cereale.

e, entire plant; *f, f*, paleæ; *g*, receptacle.

Fig. 207.

Fig. 208.

Fig. 209.



Microscopic appearance of a healthy grain of Rye (highly magnified).

Fig. 207. A thin section of a ripe grain of rye. *a*, seed-coat; *b*, inner seed-coat; *c*, layer of gluten cells; *d*, cells of the albumen filled with starch grains.

Fig. 208. A single cell of the albumen more highly magnified, and showing the starch grains with which it is filled.

Fig. 209. Grains of rye starch very highly magnified (according to Corda).

COMPOSITION.—Rye has been analyzed by Einhof,² by Boussingault,³ by Fuerstenberg,⁴ and by Payen (see *ante*, p. 106). The proportion of starch and proteine compounds contained in it, as ascertained by Krockner and Horsford, have been before stated (see *ante*, vol. i. p. 119).

RYE-SEEDS.

	<i>Einhof.</i>	<i>Boussing.</i>
Husk or bran	24.2	24
Pure meal	65.6	63.08
Moisture	10.2	12.92
	100.0	100.00

RYE-MEAL.

	<i>Einhof.</i>	<i>Boussing.</i>
Starch	61.07	64.0
Gum	11.09	11.0
Gluten	9.48	10.5
Albumen	3.28	
Saccharine matter	3.28	3.0
Husk	6.38 & salts	6.0
Undetermined acid and loss	5.42	2.0
Fatty matter	0.00	3.5
	100.00	100.0

¹ *Beitrag zur Kenntniss der Brandarten der Cerealien und des Mutterkorns*, in the *Oekonomische Neuigkeiten und Verhandlungen*, No. 83, Vienna, 1846.

² L. Gmelin, *Handb. d. Chem.* Bd. ii. S. 1343.

³ Quoted by Johnston, *Lectures on Agricultural Chemistry*.

⁴ *Journ. f. pr. Chem.* Bd. xxxi. S. 195.

The composition of the ashes of rye is stated at p. 106.

1. **PROTEINE COMPOUNDS.** *Fibrine, Glutin, and Albumen.*—The so-called gluten of rye differs from wheat-gluten. It is not cohesive, and is soluble in water and alcohol; but after it has been dissolved in alcohol it is insoluble in water. It agrees in its properties with the gluten of wheat (see vol. i. p. 116, and *ante*, p. 106). Heldt¹ considers it to be identical in composition with the other proteine compounds of rye analyzed by Dr. Berge Jones and Scheerer.

2. **STARCH.** The starch of rye, like that of wheat, consists principally of large and small grains, with but few of intermediate size; the larger ones being, on the whole, somewhat larger than the corresponding ones of wheat.² The shape of the larger grains is circular, flat, or lenticular; of the smaller ones globular (chiefly), ellipsoidal or ovoidal, rarely angular or mullar-shaped. On the flattened surface of the larger grains is seen the central, rarely circular, usually slit, or 3-, 4-, or even 5- radiate hilum, sometimes surrounded by very faint concentric rings and delicate radiating lines. By polarized light the grains show a central cross.

CHEMICAL CHARACTERISTICS.—A cold decoction of rye forms with iodine the blue iodide of starch. By washing rye-dough with water, nearly the whole becomes diffused through the liquid, little more than husk or bran remaining behind. The milky liquid deposits on standing starch grains, and the decanted portion yields on evaporation the so-called gluten; from which, sugar is extracted by water, and oil by ether: the residue (*glutin*) is soluble in alcohol.

PHYSIOLOGICAL EFFECTS.—In its nutritive qualities rye resembles wheat, especially in the fitness of its flour for making bread; but it contains less proteine matter and more sugar.

USES.—Rye is employed dietetically and medicinally; and also in the distillery and brewery.

Rye-bread (in Germany called *Schwartzbrod* or *black bread*) is in common use among the inhabitants of the northern parts of Europe, but in this country is rarely employed. It is said to be more laxative (especially to those unaccustomed to its use) than wheat-bread; and hence is sometimes taken to counteract habitual constipation. The *roasted seeds* (*semina secalis tosta*) have been employed as a substitute for coffee. On the continent *rye-flour* and *rye-bran* are applied to the same medicinal uses that wheat-flour and wheat-bran are applied in England. Rye pottage (*pulmentum vel jusculum secalinum*) is said to be a useful article of diet in consumptive cases.³

39. SECALE CORNUTUM.—SPURRED RYE OR ERGOT.

ERGOTA.—*Secale cereale semen purgo parasitico corruptum?* *L.* The ergot, a peculiar excrescence supposed to be produced by a parasitical fungus, *D.*

SYNONYMES.—*Clavi siliginis*, Lonicerus; *Secalis mater*, Thalius; *Secale luxurians*, Bauhin, Pinax, lib. i. sect. iv. p. 23; *Grana secalis degenerati*, Brunner; *Secale cornutum*, Baldinger; *Clavus secalis vel secalinus*; *Secale maternum*, turgidum vel temulentum; *Ergota*, Ph. Lond. et Ed.; *Spur*; *Spurred* or *horned Rye*; *Ergot of Rye*; *Cockspur Rye*; *Cockspur*.

HISTORY.—No undoubted reference to ergot is found in the writings of the ancients. The disease produced by it is supposed to be referred to in the following passage: "1089. A pestilent year, especially in the western parts of Lorraine, where many persons became putrid, in consequence of their inward parts being consumed by St. Anthony's fire. Their limbs were rotten, and became black like coal. They either perished miserably, or, deprived of their putrid hands and feet, were reserved for a more miserable life. Moreover, many cripples were afflicted with contraction of the sinews [*nervorum contractio*]."⁴

¹ *Ann. d. Chem. u. Pharm.* Bd. xlv. S. 199, 1843.

² The following measurements of eight (including the largest and smallest) grains of rye starch were made by Mr. George Jackson:—

1.	0.0016 of an English inch.	5.	0.0005 of an English inch.
2.	0.0015 " "	6.	0.0003 " "
3.	0.0013 " "	7.	0.0002 " "
4.	0.0010 " "	8.	0.0001 " "

³ Pearson, *Pract. Synop. of the Mat. Alim.* 91.

⁴ Extract from the works of Siebert, in the *Recueil des Histor. des Gauls et de la France*, tom. xiii. p. 259. A passage somewhat similar to the above, with the addition of the following, "the bread which

The first botanical writer who notices ergot¹ is Lonicerus.² It seems to have been employed by women to promote labour pains long before its powers were known to the profession. Camerarius,³ in 1683,⁴ mentions that it was a popular remedy in Germany for accelerating parturition. In Italy and France, also, it appears to have been long in use.⁵

BOTANY.—The nature and formation of ergot are subjects on which botanists have been much divided in opinion.

1. **Some regard ergot as a fungus growing between the glumes of grasses in the place of the ovary.**—Otto von Münchhausen,⁶ Schrank,⁷ De Candolle,⁸ Fries,⁹ Wiggers,¹⁰ and formerly Berkeley,¹¹ adopted this opinion, and described ergot as a fungus under the name of *Spermoedia Clavus*,¹² Fries (*Clavaria Clavus*, Münch.; *Sclerotium Clavus*, De Cand.). Fries and Berkeley, however, evidently entertained some doubts respecting its nature; for the first suggests that the genus *Spermoedia* consists of "*semina graminum morbosa*," and the second says, "it appears to be only a diseased state of the grain, and has scarcely sufficient claim to be admitted among fungi as a distinct genus." The latest writer who has adopted this view is Guibourt,¹³ who concludes that ergot is not an ovary or altered grain, but a fungus which, *after the destruction of the ovary*, is grafted in its place on the peduncle.

Against this opinion may be urged the circumstance noticed by Tessier,¹⁴ that a part only of the grain may be ergotized. Moreover, the scales of the base of the ergot, the frequent remains of the stigma on its top, and the articulation of it to the receptacle, prove that it is not an independent fungus, but an altered grain.¹⁵

2. **Some regard ergot as a diseased condition of the ovary or seed.**—The arguments adduced against the last opinion are in favour of the present one. Though a considerable number of writers have taken this view of the nature of ergot, there has been great discordance among them as to the causes which produced the disease.

a. *Some have supposed that ordinary morbid causes (such as moisture combined with warmth) were sufficient to give rise to this diseased condition of the grain.* Tessier¹⁶ and Willdenow¹⁷ appear to have been of this opinion.

β. *Some have ascribed the disease to the attack of insects or other animals.* Tillet, Fontana, Réad, and Field,¹⁸ supported this view, which, I may add, has subsequently been satisfactorily disproved.

γ. *Some, dissatisfied with the previously assigned causes of the disease, have been content with declaring ergot to be a disease, but without specifying the circumstances which induce it.* Mr. Bauer,¹⁹ who closely watched the development of ergot during eight years (1805–13), and has made some beautiful drawings of it in different stages, arrived at this conclusion; as also Phœbus.²⁰

δ. *Others have referred the production of the disease to the presence of a parasitic fungus.* This opinion, which appears to me to be the correct one, and which must not be confounded with that entertained by De Candolle and others (vide *supra*), has been adopted and supported by Lévillé in 1826,²¹ by Dutrochet,²² by Mr. John Smith,²³ and by the late Mr. Edwin Quekett;²⁴ and more recently by Fée²⁵ and by Corda.²⁶ But though the writers just mentioned agree in

was eaten at this period was remarkable for its deep violet colour," is quoted by Bayle (*Biblioth. Thérap.* tom. iii. p. 374) from Mézerai, *Abrégé Chronologique*. But I cannot find the passage in the first and best edition of Mézerai's *Abrégé Chron.* 3 vols. 4to. 1668; or in his *Histoire de France*; or in his *Mémoires Hist. et Critiques*. Whether or not it be in the second and less perfect edition of Mézerai's *Abrégé Chronologique*, I am unable to decide, not having seen this work.

¹ The etymology of the word *ergot* is very doubtful. Whiter (*Etymologicon Universale*, ii. 594) thinks that it is derived from *arguo*, and is attached to such terms as *urgeo*. It was anciently written *argot*.

² *Kreuterbuch*, p. 885, Franckfort, 1582.

³ *Actes des Curieux de la Nature*, art. 6, obs. 82, quoted by Velpeau.

⁴ Dierbach, *Neuest Enid.* in *d. Mat. Med.* 130, 1837.

⁵ Bayle, *Bibl. Thérap.* iii. 375. Velpeau, in his *Traité Complet de l'Art des Accouchemens*, gives an excellent literary history of ergot.

⁶ *Hauswater*, i. 332, 1764–1773.

⁷ *Mém. du Mus. d'Hist. Nat.* ii. 401, 1815.

⁸ *Inq. in Secale Corn.* Götting. 1831, in Christison's *Treatise*.

⁹ *English Flora*, vi. Part ii. 226, 1836. Mr. Berkeley is now of opinion that the ergot is produced by *Oidium abortifaciens* (see *ante*, p. 944); and in Lindley's *Medical and Economical Botany*, p. 14, 1849.

¹⁰ Erroneously quoted in the *Pharm. Lond.* 1836, as *Acinula Clavus*.

¹¹ *Hist. Nat. des Drogues*, 4me édit. t. ii. p. 72, 1849.

¹² Quekett, in *Proceedings of the Lin. Soc.* Dec. 4, 1838.

¹³ *Mém. Soc. Roy. Médéc.* 1776, p. 417; 1777, p. 587.

¹⁴ Referred to by Christison, *op. cit.*

¹⁵ *MS. British Museum*; also, *Trans. of the Linn. Society*, vol. xviii.

¹⁶ *Deutschl. kryptogam. Giftgewächse*, Berlin, 1838.

¹⁷ *Mémoires pour servir à l'Histoire anatomique et physiologique des Végét. et des Animaux*, vol. ii. p. 161, 1837.

¹⁸ *Trans. Linn. Society*, vol. xviii.

¹⁹ *Mémoire sur l'Ergot du Seigle, et sur quelques Agames qui vivent Parasites sur les Epis de cette Céréale*, 1er Mém. Strasbourg, 1843. See *Pharm. Journ.* vol. v. p. 282, 1846.

²⁰ *Beitrag zur Kenntniss der Brandarten der Cerealien und des Mutterkorns*, in the *Oekonomische Neuigkeiten und Verhandlungen*, No. 83, published at Vienna, 1846.

²¹ *Baiersche Flora*, ii. 571, 1789.

²² *Syst. Mycol.* ii. 263, 1822.

²³ Quoted by De Candolle.

²⁴ In Christison's *Treatise on Poisons*.

²⁵ *Ann. de la Soc. Linn. de Paris*.

²⁶ *Ann. de la Soc. Linn. de Paris*.

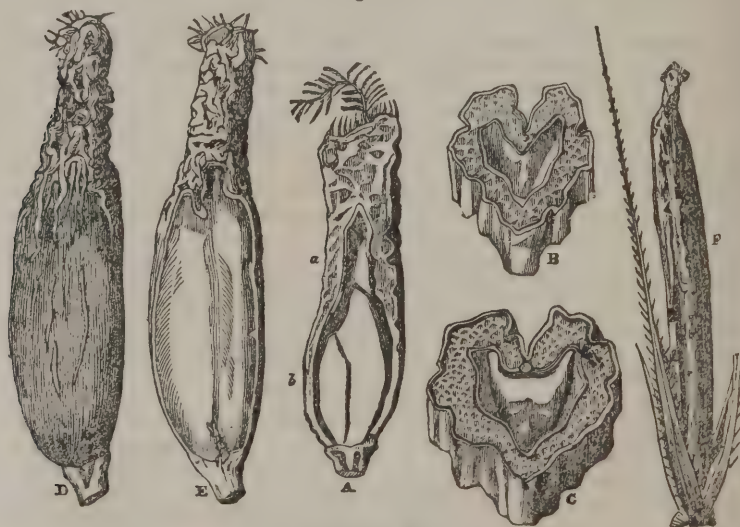
considering ergot to be a disease of the ovary or seed, caused by a parasitic fungus, considerable difference exists among them as to the real nature of the parasite.¹

The statements of Lévillé,² Phillipar,³ Smith, and Quekett, leave, I think, but little doubt that ergot is a disease of the grain caused by the presence of a parasitical fungus. This view is supported by the observations of Wiggers, that the white dust (*sporidia*, Quek.) found on the surface of ergot will produce the disease in any plant (grass?) if sprinkled in the soil at its roots. Mr. Quekett (see *ante*, p. 87) infected grains of corn by immersing them in water in which the sporidia of the *Oidium abortifaciens* were contained. The plants which were produced by the germination of the grains were all ergotized.

Mr. Quekett, who most carefully examined the development of ergot, says that the first appearance of the ergot is observed by the young grain and its appendages becoming covered with a white coating composed of multitudes of sporidia (Fig. 184 A, p. 87) mixed with minute cobweb-like filaments (*Oidium abortifaciens*, Fig. 184, H I, p. 87). This coating extends over all the other parts of the grain, cements the anthers and stigmas together, and gives the whole a mildewed appearance. When the grain is immersed in water, the sporidia fall to the bottom of the liquid. A sweet fluid—at first limpid, afterwards viscid—is found in the affected flower at this stage; and, when examined by the microscope, is found to contain the sporidia just referred to (Phillipar, Smith, Quekett). Phillipar says this fluid oozes from the floral centre; and Mr. Quekett, who at first thought that it had an external origin, was subsequently convinced that it escaped from the ergot or the parts around it.

If we examine the ergot when about half-grown (Fig. 210), we find it just beginning to show itself above the paleæ, and presenting a purplish-black colour. By

Fig. 210.



Ergot of Rye.

- A. A side view of a longitudinal section of an infected grain, soon after fecundation, when the disease makes its first external appearance: magnified eight times in diameter.
- B. Front view of a section of the above infected grain, cut at letter *a*: magnified sixteen times in diameter.
- C. Ditto, cut at letter *b*: magnified sixteen times in diameter.
- D. Side view of an unripe but advanced ergotized grain, at the upper part of which is the tuberculated portion, having a vermiciform appearance, and constituting the fungus (*Sphacelia Segetum*) of Lévillé.
- E. Longitudinal section of the grain.
- F. A full-grown ergot, within its floret, magnified twice its diameter.

¹ I have given an abstract of M. Fée's opinion in the *Pharmaceutical Journal*, vol. v. p. 292.

² *Traité Organogr. et Phys.-Agr. sur la Carie, le Charbon, l'Ergot, &c.* Evy. Versailles, 1837.

this time it has lost in part its white coating, and the production of sporidia and filaments has nearly ceased. At the upper portion of the grain, the coating now presents a vermiform appearance, which Lévillé¹ describes as constituting cerebriform undulations. These are beautifully depicted in Mr. Bauer's drawings (Fig. 210, A D E). Lévillé regards this terminal tubercle of the grain as a parasitical fungus, which he calls the *Sphacelia Segetum*. But these undulations are merely masses of sporidia; for if a little be scraped off with a knife, then moistened, and examined by the microscope, we find nothing but myriads of sporidia. The ergot now increases in a very rapid manner.

Corde has confirmed the observations of Messrs. Smith and Quekett; but, as I have already stated (see *ante*, p. 87), he considers the fungus to be a new species of *Hymenula* (of the sub-order *Hymenophycetes*), to which he has given the name of *H. clavus*.

To the agriculturist, an important subject of inquiry is the predisposing causes of ergot. Very little of a satisfactory nature has, however, been ascertained on this point. One fact, indeed, seems to have been fully established—viz. that moisture, which was formerly thought to be the fertile source of the spur, has little, if anything, to do with it.² Moreover, the disease is not peculiar to rye. Many other grasses (Phœbus has enumerated 31 species) are subject to it. In the summer of 1838, I found the following grasses, growing in Greenwich marshes, ergotized: *Lolium perenne*, *Dactylis glomerata*, *Alopecurus pratensis*, *Festuca pratensis*, *Triticum repens*, *Arundo phragmites*, *Hordeum murinum*, and *H. pratense*. Professor Henslow found it in wheat which had been sent to the miller.³ I am indebted to him also for fine specimens of ergot on *Ammodendron arundinacea*. But the disease is not confined to the Gramineæ: the Cyperaceæ are also subject to it, and perhaps, likewise, Pal-

maceæ.⁴

COMMERCE.—Ergot is imported from Germany, France, and America. The late

Fig. 211.



A full grown ear of rye, strongly infected with ergot (natural size).

¹ Quoted by Richard, *Elém. d'Hist. Nat.* i. 332.

² Phillipar, *op. cit.* 126; also, Bauer, MSS.

³ Report on the Diseases of Wheat, p. 20, from the *Journal of the Royal Agricultural Society of England*.

⁴ Phœbus, *op. cit.* 105.

Mr. Butler, of Covent Garden Market, told me that about $1\frac{1}{2}$ tons were imported in the year 1839.

DESCRIPTION.—When we examine a number of ears of ergotized rye, we find that the number of grains in each spike which have become ergotized varies considerably: there may be one only, or the spike may be covered with them.¹ Usually, the number is from three to ten.

The mature ergot (Fig. 211) projects considerably beyond the paleæ. It has a violet-black colour, and presents scarcely any filaments and sporidia.

The spurred rye, or ergot (*ergota*) of commerce, consists of grains which vary in length from a few lines to an inch, or even an inch and a half, and whose breadth is from half a line to four lines. Their form is cylindrical or obscurely triangular, with obtuse angles, tapering at the extremities (fusiform), curved like the spur of a cock, unequally furrowed on two sides, often irregularly cracked and fissured. The odour of a single grain is not detectable, but of a large quantity is fishy, peculiar, and nauseous. The taste is not very marked, but is disagreeable, and very slightly acid. The grains are externally purplish-brown or black, more or less covered by a bloom, moderately brittle, the fractured surface being tolerably smooth, and whitish or purplish-white. Their sp. gr. is somewhat greater than that of water, though, when thrown into this liquid, they usually float at first, owing to the adherent air. The lower part of the grain is sometimes heavier than the upper.

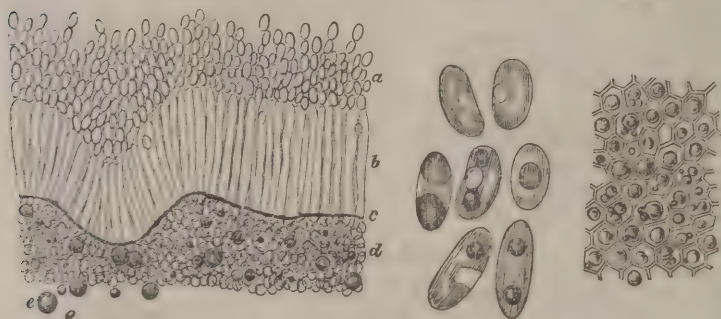
When examined by the microscope, we find that the ergot consists of three distinct parts:—

1. The *internal part* or *body* of the ergot: this is composed of the hexagonal or rounded cellular tissue. The cells have the shape and regularity of the normal cells of the albumen, but they are considerably smaller (Corda says they are only $\frac{1}{3}$ th of the size), and contain, instead of starch, from one to three globules of oil, which are lighter than water and soluble in ether (Fig. 212, *d*, and 214). If the structure of ergot be examined after the grains have been dried and re-moistened, the tissue presents a very irregular appearance.
2. The *violet* or *blackish* coat of the ergot: this consists of a layer of longitudinally elongated delicate cells (see Fig. 212, *c*).
3. The *bloom*, which to a greater or less extent, covers the violet coat of the ergot: it resembles the bloom of plums, and may be readily wiped off. According to the late Mr. Quckett, it consists of the sporidia of the *Oidium*

Fig. 212.

Fig. 213.

Fig. 214.



Microscopic appearance of Ergotized Rye (highly magnified) according to Corda.

Fig. 212. Thin transverse section of ergot of rye. *a*, layer of spores; *b*, sporophores or basidia; *c*, epidermis of the receptacle; *d*, body of the receptacle; *e*, oil globules.

Fig. 213. Spores of the fungus very highly magnified.

Fig. 214. Body of the receptacle, with the cells containing oil.

¹ Phillipar, *op. cit.* p. 96.

abortifaciens (Fig. 184, A). But Corda describes it as consisting of two parts: a layer of cylindrical, undivided cells (*sporophores* or *basidia*, Fig. 212, *b*), supporting the spores (Fig. 212, *a*, and Fig. 213).

In considering the metamorphosis which the normal rye grains have undergone by becoming ergotized, it appears that the seed coats and gluten cells (Fig. 206, *a b c*, p. 129) have been replaced by a layer of dark cells (Fig. 212, *c*); that the large cells of the albumen (Fig. 207, *d*, and Fig. 208, p. 129) have been replaced by the small cells of the ergot (Figs. 212 *d*, and 214); that the starch grains of the cells of the albumen (Fig. 208, and Fig. 209) have been replaced by drops of oil in the cells of the ergot (Fig. 212, *d*, and Fig. 214); and that the little body at the top of the ergot (Fig. 210, F *a*), which Phœbus calls the *Mützchen*, is the remains of the hairy crown of the grain, of the stigmata, and of the withered elevated pericarp.

Thus the entire organization of the grains is changed, and at the same time their effects on the animal body are altered; for while sound rye is edible, nutritive, and healthy, ergotized rye is unwholesome and poisonous, producing raphania and abortion.

DETERIORATION.—The ergot of rye is fed on by a little acarus, which is about one-fourth of the size of a cheese-mite. This animal destroys the interior of the ergot, and leaves the grain as a mere shell. It produces much powdery excrementitious matter (Quekett). In four months $7\frac{1}{2}$ ounces of this fecal matter of the acarus were formed in seven pounds of ergot. I have some ergot which has been kept for eleven years in a stoppered glass vessel without being attacked by the acarus, and it has all the characteristics of good ergot. It is advisable, however, not to use ergot which has been kept for more than two years.

COMPOSITION.—Ergot was analyzed, in 1816, by Vauquelin;¹ in 1817, by Pettenkofer;² in 1826, by Winkler;³ in 1829, by Maas;⁴ in 1831, by Wiggers;⁵ and more recently by Chevallier.⁶ The results obtained by Chevallier were analogous to those of Wiggers.

Vauquelin's Analysis.

Pale yellow matter, soluble in alcohol, and tasting like fish-oil.
White bland oil, very abundant.
Violet colouring matter, insoluble in alcohol, soluble in water.
A fixed acid (phosphoric?).
Vegeto-animal or nitrogenous matter, prone to putrefaction, and yielding ammonia and oil by distillation.
Free ammonia, disengaged at 212° F.

Wiggers's Analysis.

<i>Ergotin</i>	1.25
Peculiar fixed oil	35.00
White crystallizable fat	1.05
Cerin	0.76
Fungin	46.19
Vegetable osmazome	7.76
Peculiar saccharine matter	1.55
Gummy extractive, with red colouring matter	2.33
Albumen	1.46
Superphosphate of potash	4.42
Phosphate of lime, with trace of iron	0.29
Silica	0.14

Ergot 102.20

1. **ERGOTIN** was procured by digesting ergot with ether, to remove the fatty matter, and then in boiling alcohol. The alcoholic solution was evaporated, and the extract treated by water. The ergotin remained undissolved. It was brownish-red, with an acrid bitter taste, and, when warmed, had a peculiar but unpleasant odour. It was soluble in alcohol, but insoluble in water or ether. It is probable, therefore, that it is a resinoid colouring matter. It proved fatal to a hen. Nine grains of it were equal to an ounce and a half of ergot. It appears, then, that though a poisonous principle, it is probably not the agent which acts on the uterus, for the latter is soluble in water, whereas ergotin is not. It is possible, however, that it may be rendered soluble in water by combination with some other body.

2. **OIL OF ERGOT.**—As this is now used in medicine, its properties will be described hereafter (see p. 143).

There are no good grounds for suspecting the existence of either hydrocyanic acid or phosphate of morphia in ergot, as supposed by Pettenkofer.

¹ *Ann. Chim.* iii. 337.

² Christison, *On Poisons*.

³ Phœbus, *Giftgewächse*, 103; *Journ. de Pharm.* xviii. 525, 1832.

⁴ Dierbach, *Neuest. Entd. in d. Mat. Med.* 1837, p. 129.

⁵ Buchner's *Repert.* iii. 65.

⁶ Schwartze, *Pharm. Tabell.* 2er Ausg. 460.

CHEMICAL CHARACTERISTICS.—Ergot is inflammable, burning with a clear yellowish white flame. The aqueous infusion or decoction of ergot is red, and possesses acid properties. Both acetate and diacetate of lead cause precipitates in a decoction of ergot. Iodine gives no indication of the presence of starch. Nitrate of silver causes a copious precipitate soluble in ammonia, but insoluble in nitric acid. Tincture of nutgalls also produces a precipitate, (*tannate of ergotin?*) Alkalies heighten the red colour of the decoction.

PHYSIOLOGICAL EFFECTS.—Great discrepancy is to be found in the accounts published respecting the influence of spurred rye on man and animals. While the majority of experimenters or practical observers concur in assigning to it energetic powers, others have declared it harmless.

α. On Vegetables.—Schübler and Zeller have tried its effects on plants, and I infer from their statements that they found it poisonous.¹

β. On Animals.—Accidental observation and direct experiment concur in showing that in most instances spurred rye acts as a poison to the animal economy. But, as Phœbus correctly observes, we cannot call it a *violent* poison, since drachms and even ounces are required to destroy small animals (*e. g.* rabbits and pigeons).

It has proved poisonous to flies, leeches, birds (geese, ducks, pigeons, common fowls, &c.), and mammals, (dogs, cats, pigs, sheep, rabbits, &c.) Birds and mammals refuse to take it, even mixed with other kinds of food. Diez² gives the following as the symptoms produced by it in dogs who are compelled to swallow it: "Great aversion to it, discharge of saliva and mucus from the mouth, vomiting, dilatation of the pupil, quickened respiration and circulation, frequent moanings, trembling of the body, continual running round, staggering gait, semi-paralysis of the extremities, especially the hinder ones, sometimes diarrhœa; sometimes hot anus, increased formation of gas in the alimentary canal; faintness and sleepiness, with great thirst, but diminished appetite. Death followed under gradually increasing feebleness, without being preceded by convulsions. To the less constant symptoms belong inflammation of the conjunctiva, and the peculiar appearance of turning round in a circle from right to left." Similar observations as to its injurious operation have been made by Robert.³ In some cases abscess and gangrene of various parts of the body, with dropping off of the toes, and convulsions, have been noticed. A strong decoction injected into the vein of a dog caused general feebleness, paralysis of the posterior extremities, vomiting, and death.⁴

But there are not wanting cases apparently showing that spurred rye has no injurious action on animals. The most remarkable and striking are those related by Block.⁵ In 1811, twenty sheep ate together nine pounds of it daily for four weeks without any ill effects. In another instance, twenty sheep consumed thirteen pounds and a half daily, for two months, without injury. Thirty cows took together twenty-seven pounds daily, for three months, with impunity; and two fat cows took, in addition, nine pounds of ergot daily, with no other obvious effect than that their milk gave a bad caseous cream, which did not yield good butter. These statements furnish another proof to the toxicologist that the ruminants suffer less from vegetable poisons than other animals.

Another interesting topic of inquiry is the action of ergot on the gravid uterus of mammals. Chapman⁶ says "it never fails, in a short time, to occasion abortion." We have the testimony of Percy and Laurent, that a decoction injected into the veins of a cow caused the animal to calve speedily; and in one out of three experiments, Mr. Combes has stated, the ergot caused the abortion of a bitch.⁷ Diez⁸ found that it caused uterine contractions in dogs, rabbits, and sows. Large doses given to bitches induced an inflammatory condition of the uterus, and destroyed both mother and her young. However, in opposition to these statements, we have

¹ Marx, *Die Lehre v. d. Giften*, ii. 107.

² Christison, *op. cit.*

³ Phœbus, *op. cit.* p. 107.

⁴ Neal, *Researches respecting Spur or Ergot of Rye*, p. 90.

⁵ Quoted by Phœbus, *op. cit.* p. 108.

⁶ Gaspard, *Journ de Phys. expér.* ii. 35.

⁷ *Elem. of Therap.* i. 459, 4th edit.

⁸ Phœbus, p. 106.

the evidence of Chatard, Warner, Villeneuve, and others, who failed in producing abortion with it.¹

I am indebted to the late Mr. Youatt, formerly Veterinary Surgeon to the Zoological Society, for the following note respecting the effects of ergot on animals:—

"I have, for the last six or seven years, been in the habit of administering the ergot of rye to quadrupeds in cases of difficult or protracted parturition, in order to stimulate the uterus to renewed or increased action. In the *monogastric*, if I may venture to use the term, I have never known it fail of producing considerable effect, even when the uterus has been previously exhausted by continued and violent efforts. In the *ruminant*, with its compound stomach or stomachs, I have witnessed many a case of its successful exhibition. I have had recourse to it in the cow, the sheep, and the deer, both foreign and domestic. Parturition has not always been accomplished, from false presentations or other causes, but the uterus has in every case responded—it has been roused to a greater or less degree of renewed action. On the other hand, there are cases recorded by veterinary practitioners, in which it has been given in very large quantities without producing the slightest effect. I have always attributed this to a certain degree of forgetfulness of the construction of the stomachs of ruminants. If the medicine, as is too often the case, is poured hastily down, and from a large vessel, it breaks through the floor of the œsophagean canal and falls into the rumen, and there it remains perfectly inert. But if it is suffered to trickle down the œsophagean canal, although a portion of it may still enter the rumen, the greater part will flow on through the œsophagean canal and the manyplies into the fourth or villous stomach, and produce the desired effect."

γ. *On Man*.—These may be noticed under two heads: 1, effects of single doses; 2, effects of its continued use as an article of food.

1. *In single or few doses*.—Hertwig,² Lorinser,³ Jörg,⁴ and Diez,⁵ who have endeavoured to ascertain the effects of ergot by experiment, agree in stating that, in doses of from half a drachm to two drachms, nausea, inclination to vomit, dryness of the throat, great thirst, aversion to food, uneasiness or actual pain in the abdomen, occasionally alvine evacuations, weight and pain in the head, giddiness, in some cases stupor and dilatation of pupils, have resulted from its use. It deserves, however, to be noticed, that these effects have not been observed by some experimenters.⁶

The effects produced by the use of single or a few doses of ergot may be conveniently arranged under four heads.

α. *Effects on the uterine system*. (*Uterine contractions*.)—The action of spurred rye on the uterus, when labour has actually commenced, is usually observed in from ten to twenty minutes after the medicine has been taken, and is manifested by an increase in the violence, the continuance, and the frequency of the pains, which usually never cease until the child is born; nay, they often continue for some minutes after, and promote the speedy separation of the placenta and the firm contraction of the uterus in a globular form. The contractions and pains caused by ergot are distinguished from those of natural labour by their continuance; scarcely any interval can be perceived between them, but a sensation is experienced of one continued forcing effort. If, from any mechanical impediment (as distortion), the uterus cannot get rid of its contents, the violence of its contraction may cause its rupture, as in the cases alluded to by Dr. Merriman,⁷ Mr. Armstrong,⁸ and Mr. Coward.⁹

Ergot sometimes fails to excite uterine contractions. The causes of failure are, for the most part, conjectural. The quality of the ergot, peculiarities on the part

¹ Neul, *op. cit.*

² *Edin. Med. and Surg. Journ.* xxvi. 453.

³ Phœbus, *op. cit.*

⁴ Keil, *Diss. inaug. de Secali Cornuto*, Berol. 1822, quoted in Sundelin, *Heilmittell.*; also, Dr. Chapman, *Elem. of Therap.* vol. i. p. 488, 4th edit.

⁵ *Syn. of Diff. Part.* p. 197, 1838.

⁶ *Ibid.*, Nov. 27, 1840. Did the ergot cause the rupture, in the case related in the *Lancet*, vol. i. 1836-7, p. 624, by Mr. Hooper?

⁷ Sundelin, *Heilmittell.* i. 513, 3te Aufl.

⁸ *Gebrauch inn. Reizm. z. Beförd. d. Geburt.* 1833.

⁹ *Lond. Med. Gaz.* Aug. 4, 1838.

of the mother, and death of the fœtus, have been assigned as such. The two first will be readily admitted; but why the remedy should be altogether inert "where the fœtus has been for some time dead, and putrefaction to any extent taken place,"¹ cannot be readily explained. Its occasional failure has been urged by the late Dr. Hamilton² as an argument in favour of his notion that ergot acts "in no other way than by influencing the imagination." But, on the same ground, the sialagogue power of mercury might be denied. Dr. Hamilton's erroneous estimate of the powers of ergot is referable to a want of experience of its use; for he admits that he has only had two opportunities in practice of making a fair trial of it.

There is usually much less hemorrhage after delivery, when ergot has been employed, than where it has not been exhibited. The lochial discharges are also said to be less; but this is certainly not constantly the case. Moreover, it has been asserted "that the menstrual discharge has not recurred after the use of the ergot in certain cases of protracted parturition."³ But the inference intended to be conveyed here, viz., that ergot caused the non-recurrence, is not correct; at least, I am acquainted with several cases in which this effect did not follow the employment of spurred rye, and I know of none in which it did.

Ergot has been charged with causing the death of the child; but the charge has been repelled by some experienced practitioners as being devoid of the least foundation. "The ergot," says Dr. Hosack,⁴ "has been called, in some of the books, from its effects in hastening labour, the *pulvis ad partum*; as it regards the child, it may, with almost equal truth, be denominated the *pulvis ad mortem*; for I believe its operation, when sufficient to expel the child, in cases where nature is alone unequal to the task, is to produce so violent a contraction of the womb, and consequent convulsion and compression of the uterine vessels as very much to impede, if not totally to interrupt, the circulation between the mother and child." However, Dr. Chapman⁵ strongly denies this charge, and tells us that in 200 cases which occurred in the practice of himself and Drs. Dewees and James, the ergot was used without doing harm in any respect; and, he adds, "no one here believes in the alleged deleterious influence of the article on the fœtus." It is not improbable, however, where the impediment to labour is very great, that the violent action of the uterus may be attended with the result stated by Dr. Hosack. Dr. F. H. Ramsbotham⁶ has suggested that the poisonous influence of ergot may be extended from the mother to the fœtus, as in the case of opium. He also states⁷ that of 36 cases in which he induced premature labour by puncturing the membranes, 21 children were born alive; while, in 26 cases of premature labour induced by ergot only, 12 children only were born alive. This fact strongly favours the notion of the deleterious influence of the ergot on the fœtus.

Given to excite abortion, or premature labour, ergot has sometimes failed to produce the desired effect. Hence, many experienced accoucheurs have concluded that, for this medicine to have any effect on the uterus, it was necessary that the process of labour should have actually commenced.⁸ But, while we admit that it sometimes fails, we have abundant evidence to prove that it frequently succeeds; and most practitioners, I think, are now satisfied that in a large number of cases it has the power of originating the process of accouchement. Cases illustrating its power in this respect are referred to by Bayle;⁹ and others are mentioned by Waller,¹⁰ Holmes,¹¹ Ramsbotham,¹² Müller,¹³ and others.

The action of ergot on the unimpregnated uterus is manifested by painful contractions, frequently denominated "bearing-down pains," and by the obvious

¹ Dr. Bibby, in Merriman's *Synopsis*, p. 198.

² *Pract. Observ. relating to Midwifery*, part ii. p. 64, 1836.

³ Dr. J. W. Francis, in the 3d American edition of Denman's *Midwifery*, 1829.

⁴ *Essays*, vol. ii. 296.

⁵ *Lond. Med. Gaz.* vol. xiv. p. 84.

⁶ Bayle, *Bibl. Thérap.* iii. 550.

⁷ *Lancet*, 1828, vol. x. p. 54.

⁸ *Lond. Med. Gaz.* xiv. pp. 85 and 434; also, *Lond. Med. Gaz.* June 15, 1839.

⁹ Dierbach, *Neuesten Entd. in d. Mat. Med.* i. 139, 1837.

¹⁰ *Elem. of Therap.* i. 468, 4th edit.

¹¹ *Ibid.*, June 15, 1839.

¹² *Op. cit.* p. 550.

¹³ *Ibid.*, 1827-28, vol. ii. p. 794.

influence which it exercises over various morbid conditions of this viscus; more particularly by its checking uterine hemorrhage, and expelling polypous masses. Tenderness of the uterus, and even actual metritis, are said to have been induced by it.¹

β. *Effects on the Cerebro-Spinal System. (Narcotism).*—Weight and pain in the head, giddiness, delirium, dilatation of pupil, and stupor, are the principal symptoms which indicate the action of ergot of rye on the brain. Dr. Maunsell² has published five cases (viz., two which occurred to Dr. Churchill, one to Dr. Johnson, and two to Dr. Cusack), in which delirium or stupor resulted from the use of ergot (in half-drachm and two-drachm doses), and was accompanied by great depression of pulse.³ Trousseau and Pidoux⁴ found that under the repeated use of ergot, dilatation of pupil was the most common symptom of cerebral disorder. It began to be obvious in from twelve to twenty-four hours after the commencement of the use of the medicine, and sometimes continued for several days after its cessation. The cerebral disorder is frequently preceded by the uterine contractions, and usually remains for some time after these have subsided.

Effects of ergot on the Circulatory System.—I have known increased frequency and fulness of pulse, copious perspiration, and flushed countenance, follow the use of ergot during parturition. But in most instances the opposite effect has been induced; the patient has experienced great faintness, the pulse has been greatly diminished in both frequency and fulness, and the face has become pale or livid. In one case, mentioned by Dr. Cusack,⁵ the pulse was reduced from 120 to 90. Dr. Maunsell has referred to four other cases. These effects on the circulatory system were accompanied with cerebral disorder, of which they were probably consequences. Similar observations, as to the power of ergot to diminish the frequency of the pulse, have been noticed by others.⁶

δ. *Other effects of ergot.*—Nausea and vomiting are not uncommon consequences of the exhibition of ergot when the stomach is in an irritable condition. Various other symptoms have been ascribed to the use of ergot; such as weariness of the limbs and itching of the skin.⁷

2. *Effects produced by the continued use of ergot as an article of food (Ergotism, Fr.; Raphania, Linn., Vog., Cull., Good; Convulsio raphania, and Eclampsia typhodes, Sauv.; Morbus spasmodicus, Rothm.; Morbus convulsivus, malignus, epidemicus, cerealis, &c., Alt.; Kriebelkrankheit, or the creeping sickness, Germ.).*—Different parts of the continent, *e. g.* France (especially in the district of Sologne), Silesia, Prussia, Bohemia, Saxony, Denmark, Switzerland, and Sweden, have been, at various periods, visited with a dangerous epidemic (known by the names above mentioned), which affected, at the same time, whole districts of country, attacking persons of both sexes and of all ages.⁸ So long back as 1597 (Tissot), the use of ergotized rye was thought to be the cause of it. Various circumstances have appeared to prove the correctness of this opinion,⁹ which has been further confirmed by the effects of ergot on animals, as well as by the occurrence of a disease similar to, if not identical with, ergotism, in consequence of the use of damaged wheat.¹⁰ Yet several intelligent writers have not acquiesced in this view; and the circumstances mentioned by Trousseau,¹¹ and by Dr. Hamilton,¹² are certainly calculated to throw some doubts over the usually received opinion.

Ergotism assumes two types; the one of which has been denominated the *convulsive*, the other the *gangrenous ergotism*. Whether these arise from different conditions of the ergot, or from peculiarities on the part of the patient, or from the

¹ Dr. Negri, *Lond. Med. Gaz.* xiv. 369.

² *Lond. Med. Gaz.* xvi. 606.

³ See, also, Dr. Cusack, in *Dubl. Hosp. Rep.* vol. v. p. 509.

⁴ *Traité de Thérap.* i. 546.

⁵ Dr. Maunsell, *Lond. Med. Gaz.* xiv. 606.

⁶ Merriman, *Synopsis*, pp. 201 and 203, 1838; Trousseau and Pidoux, *Traité de Thérap.* i. 547.

⁷ Trousseau and Pidoux, *op. cit.* i. 547.

⁸ Tissot, *Phil. Trans.* vol. lv; Rothman, *Amæn. Acad.* vi. 430.

⁹ *Mém. de la Soc. Roy. de Méd.* i. 1777.

¹⁰ *Phil. Trans.* for 1762; Henslow, *op. supra cit.*

¹¹ *Traité de Thérap.* i. 327.

¹² *Practical Observations relative to Midwifery*, part ii. p. 25.

different quantity of the ergot taken, we are hardly prepared now to say. In *convulsive ergotism*, the symptoms are weariness, giddiness, contraction of the muscles of the extremities, formication, dimness of sight, loss of sensibility, voracious appetite, yellow countenance, and convulsions, followed by death. In the *gangrenous ergotism* there is also experienced formication; that is, a feeling as if insects were creeping over the skin, voracious appetite, coldness and insensibility of the extremities, followed by gangrene.¹

USES.—To Dr. Stearns, of the United States, is due the credit of introducing ergot of rye to the notice of the profession as an agent specifically exciting uterine contractions.² In 1814, a paper was published by Mr. Prescott,³ on the effects of it in exciting labour-pains, and in uterine hemorrhage. It was not employed in England until 1824. The following are the principal uses of it:—

1. *To increase the expulsive efforts of the womb in protracted or lingering labours.*—When the delay of delivery is ascribable solely to the feeble contractions of the uterus, ergot is admissible, provided, first, that there be a proper conformation of the pelvis and soft parts; secondly, that the os uteri, vagina, and os externum, be dilated, or readily dilatable, and lubricated with a sufficient secretion; and, lastly, that the child be presenting naturally, or so that it shall form no great mechanical impediment to delivery. A natural position of the head is not an absolute essential for the use of ergot, since this medicine is admissible in some cases of breech presentation.⁴ The circumstances which especially contraindicate or preclude the use of this medicine are those which create an unusual resistance to the passage of the child: such are, disproportion between the size of the head and of the pelvis, great rigidity of the soft parts, and extraneous growths. Moreover, “earliness of the stage” of labour is laid down by Dr. Bigelow⁵ as a circumstance contraindicating the use of ergot. The proper period for its exhibition is when the head of the child has passed the brim of the pelvis. Some practitioners assert that a dilated or lax condition of the os uteri is not an essential requisite for the exhibition of ergot. It has been contended that one of the valuable properties of this medicine is to cause the dilatation of the uterine orifice; and cases are not wanting to confirm these statements.⁶

2. *To hasten delivery when the life of the patient is endangered by some alarming symptom.*—Thus, in serious hemorrhages occurring during labour, after the rupture of the membranes, and where the placenta is not situated over the os uteri, the ergot is especially indicated.⁷ It has also been employed to accelerate delivery in puerperal convulsions. Five successful cases of its use are recorded by Bayle,⁸ on the authority of Waterhouse, Mitchell, Roche, Brinkle, and Godquin. But the narcotic operation of ergot presents a serious objection to its use in cerebral affections.

3. *To provoke the expulsion of the placenta when its retention depends on a want of contraction of the uterus.*—In such cases, ergot has often proved of great advantage.⁹ When the hemorrhage is excessive, the ergot must not be regarded as a substitute for manual extraction, since, during the time required for its operation, the patient may die from loss of blood.¹⁰ In retention of the placenta from spasmodic or irregular contraction of the uterus, as well as from morbid adhesion, ergot is improper or useless.¹¹

4. *To provoke the expulsion of sanguineous clots, hydatids, and polypi from the*

¹ Christison, *Treatise on Poisons*; Orfila, *Toxicol. Gén.*; Phil. Trans. 1702; Henslow's *Report on the Diseases of Wheat*, in the *Journal of the Royal Agricultural Society of England*, vol. ii. 1841.

² *New York Med. Repos.* vol. xi. 1807; quoted in the *United States Dispensatory*.

³ *Med. and Phys. Journ.* vol. xxxii. p. 90, 1815.

⁴ Dr. F. H. Ramsbotham, *Lond. Med. Gaz.* xiv. 86.

⁵ *Quarterly Journal of Literature, Science, and Arts*, ii. 63.

⁶ Bayle, *op. cit.* p. 539.

⁷ Dr. Blundell, *Lancet* for 1827-28, vol. i. p. 805; Dr. F. H. Ramsbotham, *Lond. Med. Gaz.* vol. xvi. pp. 86 and 692.

⁸ *Bibl. Thérap.* iii. 448 and 548.

⁹ Dr. Blundell, *Lancet*, 1827-28, vol. ii. 259; Bayle (*Bibl. Thérap.* vol. iii. 541) has recorded nine cases from Balardini, Bordol, Davies, Duchâteau, and Morgan; and many others will be found in the medical journals.

¹⁰ Dr. F. H. Ramsbotham, *Lond. Med. Gaz.* xiv. 738.

¹¹ Dr. Jackson, *Lond. Med. Gaz.* iv. 105.

uterus.—Coagula of blood collected within the womb after delivery may sometimes require the use of ergot to excite the uterus to expel them, as in the case mentioned by Mackenzie.¹ Ergot is also valuable in promoting the expulsion of those remarkable formations called uterine hydatids,² and which are distinguished from the acephalocysts of other parts of the body by their not possessing an independent life, so that when separated from their pedicles they die.³ A successful case of the use of ergot in this affection has been published by Dr. Macgill.⁴ In uterine polypus, ergot has been exhibited with the view of hastening the descent of the tumour from the uterus into the vagina, so as to render it readily accessible for mechanical extirpation;⁵ for it is well known that, until this is effected, the patient is continually subject to hemorrhage, which in some cases proves fatal. In some instances, ergot has caused the expulsion of a polypus.⁶

5. *To restrain uterine hemorrhage, whether puerperal or non-puerperal*.—Ergot checks hemorrhage from the womb, principally, if not solely, by exciting contraction of the muscular fibres of this viscus, by which its blood-vessels are compressed and emptied, and their orifices closed. The experience of physicians and surgeons in all parts of the civilized world has fully and incontestably established the efficacy of ergot as a remedy for uterine hemorrhage.⁷ Maisonneuve and Trousseau⁸ have shown that the beneficial influence of ergot is exerted equally in the unimpregnated as in the impregnated state; proving, therefore, that the contrary statement of Prescott and Villeneuve is incorrect. Even in a case of cancer of the uterus, they have found it check the sanguineous discharge. In females subject to profuse uterine hemorrhages after delivery, ergot may be administered as a preventive, just before the birth of the child.⁹ Even in placenta presentations, a dose or two of ergot may be administered previously to the delivery being undertaken.¹⁰ To restrain excessive discharge of the lochia or catamenia, this remedy is sometimes most beneficial.

6. *To provoke abortion, and to promote it when this process has commenced and is accompanied with hemorrhage*.—Under certain circumstances, the practitioner finds it expedient to produce abortion: as in serious hemorrhage during pregnancy, and in deformed pelves which do not admit the passage of a full-grown fœtus. In such cases, the ergot may be employed with great advantage.¹¹ When abortion has already commenced, ergot may be employed to quicken the process and check hemorrhage.

7. *In leucorrhœa and gonorrhœa*.—Ergot was first given in leucorrhœa by Dr. M. Hall;¹² and was subsequently employed by Dr. Spajrani¹³ with success; and in eight cases by Dr. Bazzoni,¹⁴ seven of these were cured by it. Dr. Negri¹⁵ published seven successful cases of its use. Its efficacy has been confirmed by many other practitioners. Dr. Negri also used it with apparent benefit in gonorrhœa, in both the male and female. He concludes that “*secale cornutum* has a peculiar action on the mucous membranes; but, if exhibited when there is a state of acute inflammation, their morbid secretions may be considerably increased; on the contrary, when a more chronic form of inflammation does exist, the *secale cornutum* may have a beneficial influence in arresting their preternatural discharge.”

8. *In hemorrhages generally*.—The power possessed by ergot of exciting uterine contractions, readily explains the efficacy of this agent in restraining sanguineous discharges from the womb; but it has also been used to check hemorrhage from other organs. In these cases it can only act as a sedative to the circulation, in a

¹ Neal, *Researches*, p. 88.

² *Acephalocystis racemosa*, H. Cloq.

³ Cruveilhier, *Dict. de Méd. et de Chir. prat. art. Acéphalocystes*, p. 260.

⁴ Bayle, *op. cit.* p. 471.

⁵ Dr. H. Davies, *Lond. Med. and Phys. Journ.* vol. liv. p. 102, 1825.

⁶ *Lancet*, 1828-9, vol. i. p. 24.

⁷ See the list of cases in Bayle's *Bibl. Thérap.* iii. 543.

⁸ *Bull. de Thérap.* t. iv.; also, Trousseau and Pidoux, *Traité de Thérap.* i. 540.

⁹ Roche, *Dict. de Méd. et Chir. prat. art. Ergot*, p. 455.

¹⁰ Dr. F. H. Ramsbotham, *Lond. Med. Gaz.* xiv. 660.

¹¹ *Ibid.*, p. 434; also, Dr. Weihe, in *op. cit.* vol. xviii. 543.

¹² *Lond. Med. and Phys. Journ.* May, 1829.

¹³ Bayle, p. 509.

¹⁴ *Lancet*, Feb. 5th, 1831.

¹⁵ *Lond. Med. Gaz.* xiii. p. 369.

similar way to foxglove. A considerable number of cases have been published in proof of its power of checking hemorrhage from other organs (as the nose, gums, chest, stomach, and rectum).¹ But, having found it unsuccessful in my own practice, seeing that in the hands of others it has also failed,² and knowing how difficult it is to ascertain the influence of remedies on hemorrhages, I think further evidence is required to prove the anti-hemorrhagic powers of ergot.

9. *In amenorrhœa*.—Some few cases have been published tending to show that ergot possesses emmenagogue properties.³ It appears to me to be more calculated to cause than to relieve amenorrhœa.

10. *In other diseases*.—Ergot has been employed in various other diseases with apparent success; viz., intermittent fever,⁴ paraplegia,⁵ &c.

ADMINISTRATION.—Ergot is usually given in the form either of powder or infusion. The decoction, less frequently the tincture, and still more rarely the extract, are also used. Latterly, the ethereal oily extract and oil have been used.

1. *PULVIS ERGOTÆ; Pulvis Secalis Cornuti; Powdered Ergot*.—This powder is only to be prepared when required for use. The dose of it, for a woman in labour, is twenty grains, to be repeated at intervals of half an hour for three times; for other occasions (as leucorrhœa, hemorrhages, &c.), five to ten or fifteen grains three times a day: its use should not be continued for any great length of time. It may be taken mixed with powdered sugar. It has had the various names of *pulvis parturiens* (more correctly *parturifaciens*), *pulvis ad partum*, *pulvis partem accelerans*, *obstetrical powder*, &c.

2. *INFUSUM ERGOTÆ, D.; Infusum Secalis Cornuti; Infusion of Ergot*.—Ergot, in coarse powder, ℥ij; Boiling Water f℥ix. Infuse for one hour, in a covered vessel, and strain. The product should measure about eight ounces. The dose for a woman in labour is f℥ij, to be repeated at intervals of half an hour or an hour. Sugar, aromatics (as nutmeg or cinnamon), or a little wine or brandy, may be added to flavour it.

3. *TINCTURA ERGOTÆ, D.; Tinctura Secalis Cornuti; Tincture of Ergot*.—(Ergot, in coarse powder, ℥viii; Proof Spirit Oij. Macerate for fourteen days, strain, express, and filter, *D*).—Five fluidrachms of this tincture contain one drachm of ergot. Dose ℥j to ℥iij.

Various other formulæ have been published,⁶ some made with rectified, others with proof, spirit. In most of them the proportion of ergot is smaller than in the Dublin formula. One formula⁷ orders of Ergot, bruised, f℥j; Boiling Water f℥ij. Infuse for twenty-four hours, and add Rectified Spirit f℥iss. Digest for ten days. Half a drachm of this tincture is said to be equivalent to ten grains of the powder. One or two spoonfuls of a tincture of ergot (prepared by digesting ℥ss of ergot in ℥iv of rectified spirit), mixed with water, has been recommended as an injection into the uterus in difficult labour. It is to be introduced between the head of the child and the neck of the uterus.⁸

4. *TINCTURA ERGOTÆ ÆTHEREA, L.; Tinctura Secalis Cornuti Ætherea; Ethereal Tincture of Ergot*.—(Ergot, bruised, ℥xv; Ether Oij. Macerate for seven days; then express and strain, *L*).—Half a fluidounce of this tincture contains a drachm and a half of ergot. The dose is a teaspoonful. The objection to this preparation is that it is not miscible with water.

The *ethereal solution of ergot*, used by Dr. Lever⁹ to promote uterine contraction, is essentially a solution of the oil of ergot. It was prepared by digesting ℥iv of

¹ See the cases of Drs. Spajrani, Pignaccio, and Gabini, in the *Lancet* for 1830 and 1831; of Dr. Negri, in the *Lond. Med. Gaz.* xiii. 361.

² Trousseau and Pidoux, *Traité de Thérap.* i. 546.

³ Dierbach, *op. cit.* p. 444.

⁴ Dierbach, *Neuesten Entd. in d. Mat. Med.* i. 147, 1838.

⁵ *Lehrb. d. Gynécologie*, i. 280, 1827.

⁶ *Lond. Med. Gaz.* N. S. vol. ii. for 1839-40, p. 108.

⁷ Neal, *Researches*, p. 79.

⁸ Bayle, *op. cit.* p. 548.

⁹ *Lancet*, 1827-28, vol. ii. p. 435.

powdered ergot in fʒiv of ether during seven days. The tincture was submitted to spontaneous evaporation, and the residue dissolved in fʒij of ether. The dose of this solution is from ℥xv to ℥xxx on a lump of sugar.

[5. VINUM ERGOTÆ, U. S.; *Wine of Ergot*.—Take of Ergot, bruised, two ounces; White Wine a pint. Macerate for fourteen days, with occasional agitation; then express and filter through paper. This preparation is used as a substitute for the tincture. Dose, fʒj, or fʒij.]

6. OLEUM ERGOTÆ; *Oil of Ergot*.—The liquid sold in the shops under the name of *pure oil of ergot* is obtained by submitting the ethereal tincture of ergot to evaporation by a very gentle heat. Its colour is reddish brown. Mr. Wright¹ states that this depends on the age of the ergot, and that when obtained from recent specimens it is not unfrequently entirely free from colour. Its taste is oily and slightly acrid. It is lighter than water, and is soluble in alcohol and in solutions of the caustic alkalies. It is probably a mixture of several proximate principles. I made a guinea-pig swallow a fluidrachm of it: the only obvious effect was copious and frequent diuresis. Two fluidrachms diffused through water and injected into the jugular vein of a dog, caused trembling of the muscles, paralysis of the hind, and great weakness of the fore legs, which lasted for more than two days. The respiration and action of the heart were exceedingly rapid. The saliva streamed copiously from the mouth. The pupil was strongly dilated before the experiment, and no obvious change in it was induced by the oil. Mr. Wright found the oil very energetic. A drachm, he states, injected into the jugular vein caused dilatation of the pupil, feeble, slow, and intermittent action of the heart, deep and interrupted respiration, general paralysis, insensibility to punctures, and death in two hours and forty minutes.

According to evidence adduced by Mr. Wright, the oil possesses the same influence over the uterus as that of the crude drug; that is, it occasions powerful uterine contractions. To produce this effect, it should be given in doses of from 20 to 50 drops in any convenient vehicle, as cold water, warm tea, or weak spirit and water.

7. EXTRACTUM ERGOTÆ; *Extractum Secalis Cornuti*; *Bonjean's Ergotine*.—This is prepared by exhausting ergot of rye by means of water, and evaporating the liquors to the consistence of syrup. To this extract is to be added a considerable excess of alcohol, by which all the gummy matters and salts insoluble in alcohol are precipitated. The supernatant liquid is to be decanted and reduced in a water bath to the consistence of a soft extract. From 100 parts of ergot, from 14 to 16 parts of extract, called, by Bonjean, *ergotine*, are obtained. This extract is soft, reddish-brown, and homogeneous; has an odour of roast meat, and a slightly piquant bitter taste. It may be employed medicinally in substance, made into pills, or dissolved in water. The dose of it is from five to ten grains. The aqueous solution of it is red, limpid, and transparent.

ANTIDOTE.—The proper treatment to be adopted in a case of poisoning by an overdose of ergot has not been accurately determined. The first object would be, of course, to evacuate the poison from the alimentary canal by the use of emetics or purgatives. As chlorine decomposes ergotin, Phœbus recommends the employment of chlorine water. In the absence of this, nitro-hydrochloric acid (properly diluted) might be exhibited. The subsequent treatment should be conducted on general principles.

¹ *Ed. Med. and Surg. Journal*, vol. liv. p. 52.

TRIBE V. ANDROPOGONEÆ, *Kunth*.40. SACCHARUM OFFICINARUM, *Linn.*—THE SUGAR CANE.*Sex. Syst.* Triandria, Digynia.

(*Saccharum*; *caulis succus præparatus purificatus crystallinus*. *Sacchari Fæx*; *succus præparatus impurus*, *L.*—*Saccharum commune*; *Sacchari Fæx*; *Saccharum purum*, *E.*—*Saccharum purificatum*; Refined Sugar; White Sugar.—*Theriaca*; *Treacle*; *Molasses*; or the concentrated uncrystallized juice, *D.*)

HISTORY.—The manufacture of sugar is said by Humboldt to be of the highest antiquity in China. Cane-sugar was known to the ancient Greeks and Romans, and was considered by them to be a kind of honey. Possibly, Herodotus¹ refers to it when he says that the Zygantes make honey in addition to that which they get from bees. Theophrastus² calls it *mel in arundinibus*; Dioscorides³ terms it *σάκχαρον*; Pliny⁴ *saccharum*. Humboldt⁵ adopts too hastily, I think, the opinion of Salmasius, that the latter writers meant the siliceous product of the Bamboo, viz., *Tabasheer*; for, in the first place, as they arrange it with honey, it was probably sweet, which *tabasheer* is not; secondly, the Sanscrit name for sugar is *Sarkura*;⁶ thirdly, a passage in Lucan⁷ seems distinctly to refer to the sugar-cane: "Quique bibunt tenera dulces ab arundine succos." Surely no one will pretend that the bamboo is a "tenera arundo?"⁸

BOTANY. **Gen. Char.**—*Spikelets* all fertile, in pairs; the one sessile, the other stalked; articulated at the base, two-flowered; the lower floret neuter, with one palea; the upper hermaphrodite, with two paleæ. *Glumes* two, membranous. *Paleæ* transparent, awnless; those of the hermaphrodite flower minute, unequal. *Stamens* three. *Ovary* smooth. *Styles* two, long; *stigmas* feathered, with simple toothletted hairs. *Scales* two, obscurely two or three-lobed at the point, distinct. *Caryopsis* smooth (?), loose (?) (*Kunth*).

Sp. Char.—*Panicle* effuse. *Flowers* triandrous. *Glumes* obscurely one-nerved, with very long hairs on the back (*Kunth*).

The *stem* is solid, from six to twelve feet high. *Leaves* flat. *Panicle* terminal, from one to three feet long, of gray colour, from the long soft hair that surrounds the flower. *Paleæ* rose-coloured.

Kunth admits four varieties:—

α. *commune*, the common yellow cane, called by the Bengalees *Poori*, and, by the West Indians, the *Creole Cane* or *Native Cane*, from its having been the one originally introduced into the New World.

β. *purpureum*, the purple cane, called by the Bengalees *Kajooli*, and which is said to yield juice one-eighth richer than the yellow cane.

γ. *giganteum*, the giant cane, a large light-coloured cane, called by the Bengalees *Kulloo*. It grows in a low swampy soil, where the other two will not succeed. Its juice is weaker than that of the yellow cane, but the plant grows to a much larger size; and it is, therefore, much cultivated in India.

δ. *tahitense*, the *Tahiti cane*, commonly called the *Otaheite cane*.

Hab.—It is cultivated in both Indies. Its native country is uncertain.

Two other species of *Saccharum* are cultivated for the sugar they produce:—

S. *VIOLACEUM*, Tussac, Antill. i. 160—*Kunth*, Agrostogr. i. 474; *Violet Sugar-cane*. (By some authors considered to be identical with *Tahiti sugar cane* above mentioned.)—Cultivated in both Indies.

S. *SINENSE*, Roxb., Fl. Ind.; *China Sugar-cane*.—Cultivated in China, where sugar is made from it.

¹ Lib. iv. *Melpomene*, cap. cxciv.

² Lib. ii. cap. civ.

³ *Journal of Science and Arts*, vol. v. p. 15.

⁴ *Royle's Essay*, p. 83.—In his more recent work, called *Cosmos*, Humboldt (*Sabine's* transl. vol. ii. pp. 109 and xxvi.) states that the Sanscrit name for sugar is the source of the Greek and Semitic names for it.

⁵ Lib. iii. v. 237.

⁶ References to passages in other ancient authors will be found in the notes to Valpy's edit. of *Pliny's Hist. Nat.* vol. iv. 2193; see, also, Moseley's *Treatise on Sugar*, Lond. 1799.

² *De Melle*.

⁴ *Hist. Nat.* lib. xii. cap. xvii.

COMPOSITION OF THE SUGAR-CANE.—Avequin¹ analyzed the Tahiti and ribbon varieties of the fresh sugar-cane of Louisiana, and Dupuy² analyzed the fresh sugar-cane at Guadaloupe. Peligot,³ by combining the composition of cane-juice with that of the dried canes sent him from Martinique, has also deduced the composition of the fresh cane. More recently, Casaseca⁴ analyzed the sugar-cane of Cuba.

	Avequin.			
	Dupuy.	Peligot.	Tahiti Cane.	Ribbon Cane.
Sugar	17.8	18.0	14.280	13.392
Cellulose	9.8	9.9	8.867	9.071
Mucilaginous, resinous, fatty, and } albuminous matter	—	—	0.415	0.441
Salts	0.4	— { Salts, silica, and } oxide of iron {	0.358	0.368
Water	72.0	72.1	76.080	76.729
Fresh sugar-cane	100.0	100.0	100.000	100.001

The dried sugar-cane was analyzed by O. Hervy.⁵

The composition of *sugar cane ash* is an important consideration for the sugar-planter, as it enables him to deduce the most appropriate manure for promoting the growth of the cane.⁶

The sugar-cane, especially the violet variety, is coated by a glaucous powder of a peculiar kind of wax, which has been called *cerosine* or *sugar-cane wax*.⁷ This is fusible at 180° F., and dissolves in boiling alcohol: the alcoholic solution, even when it contains but a small quantity of cerosine, gelatinizes or solidifies on cooling like an alcoholic solution of soap. The composition of this wax is C⁴⁸H⁵⁰O² (Dumas).

EXTRACTION OF CANE-JUICE.—Cane-juice is generally extracted from the stems by means of the *sugar mill*. The canes, when ripe, are cut close to the ground, stripped of their leaves, and carried in bundles to the mill-house, where they are twice subjected to pressure between iron rollers, placed either vertically or horizontally. The residue of the canes which have been thus crushed and deprived of their juice is called *megass*.

Other methods of extracting the cane juice have been suggested. The *hydraulic press* has been introduced into Jamaica and St. Vincent's. By *Michiel's patent* it is proposed to macerate thin slices of the cane in a mixture of lime and water, so as to coagulate the albuminous matters but to extract the sugar. It has also been proposed to extract the sugar in Europe from the canes imported in the dried state.⁸

PROPERTIES OF CANE-JUICE.—Cane-juice is pale yellowish-gray, and has an agreeable sweet taste and a faint fragrant odour. As it flows from the mill it is frothy, and, owing to the suspension in it of finely-divided matter, is turbid or opalescent. Its sp. gr. ranges from 1.067 to 1.106: Mr. Fownes⁹ found it to be from 1.070 to 1.090. By boiling, its turbidity is commonly a little increased, and sometimes a few small flocks are separated from it. Both nitric acid and corrosive sublimate occasion, after a time, a very slight precipitate. A large addition of alcohol throws down flocks resembling gum or dextrine. A few drops of sulphate of copper, and an excess of caustic potash, occasion, on heating, a very abundant red precipitate of suboxide of copper, indicative of the presence of glucose or grape-sugar.

According to Mr. Fownes, the juice contains the following substances: *Cane-sugar* in great quantity, a notable amount of *glucose* or *grape-sugar*, *gum* or *dextrine*, *phosphates of lime and magnesia*, some *other salt of lime and magnesia*, *sulphates* and *chlorides*, *potash* and *soda*, and, lastly, a *peculiar azotized matter* belonging to the albuminous family, forming an insoluble compound with lime,

¹ Journ. de Chimie Méd. t. ii. 2de Sér. pp. 26 and 132, 1836.

² Quoted by Dumas, *Traité de Chimie*, t. vi. p. 209, 1843.

³ Journ. de Pharm. t. xxvi. p. 151, 1840.

⁴ Ann. de Chim. et Phys. 3me Sér. t. xi. p. 39, 1814.

⁵ Journ. de Pharm. t. xxvi. p. 569, 1840.

⁶ For analyses of the ash of the entire sugar-cane, as well as of the crushed and pressed cane (*megass*), see Johnston's *Lectures on Agricultural Chemistry*, pp. 393 and 628, 2d edit. 1817. The same author also gives the formula for a special manure for the sugar-cane, deduced from the analyses of the ash (*op. cit.* p. 614).

⁷ Journ. de Pharm. t. xxvi. p. 738, 1840.

⁸ For further details, see Dr. Evans's *Sugar-Planter's Manual*, 1847.

⁹ *Pharmaceutical Journal*, vol. viii. p. 15, 1848.

not coagulable by heat or acids, and readily putrefiable. Of ordinary *vegetable albumen* there are but indistinct traces, and of caseine or legumine none. Avequin found a portion of *cerosine* or sugar-cane wax in cane-juice. It is detached from the canes in the mill.

Cane-juice has been analyzed by Proust,¹ by Avequin,² by Peligot,³ by Plagne,⁴ and by Casaseca.⁵ The following are their more important results:—

	Avequin.	Peligot.	Plagne.	Casaseca.
Sugar	15.784	20.90	20.8000	20.94
Various organic matters . . .	0.140	0.23	0.8317	0.12
Salts	0.236	0.17	small quantities	0.14
Water	83.840	78.70	78.3325	78.80
Cane-juice	100.000	100.00	99.9642	100.00

It appears, therefore, from these analyses, that cane-juice contains about 20 per cent. of saccharine matter. Or, assuming that the juice has an average sp. gr. of 1.073, the quantity will be 18 per cent. Moreover, according to both Peligot and Casaseca, the whole of the saccharine matter is crystallizable, or true cane-sugar; the uncrystallizable sugar, or molasses, which is obtained by evaporation from the juice, being the product of alterations effected in the crystallizable sugar by the operation: but Mr. Fownes observed that this statement must be received with some reservation.

Of late years, *concentrated West Indian cane-juice* has been imported. It contains nearly half its weight of granular sugar, besides a variable amount of molasses.

CLARIFICATION OF CANE-JUICE.—The clarification or defecation of cane-juice is effected, usually in large copper vessels of the capacity of 300 or 400 gallons, by the combined use of heat and lime: the latter is technically called “the *temper*.” The heat serves to coagulate any vegetable albumen which may be present. The lime neutralizes the free acid and combines with the peculiar albuminous or proteine body mentioned by Mr. Fownes, and forms a coagulum, the separation of which is promoted by the heat. Part of it rises to the top as a scum, and the remainder subsides as a thick muddy deposit.

Various other substances⁶ have been tried as a substitute for lime with more or less success. Diacetate of lead has been employed for this purpose, but its use has been discontinued on account of a great number of persons having suffered the ill effects of this metal from partaking of sugar prepared with it.

CONCENTRATION OF THE CANE-JUICE.—The clarified juice should be filtered prior to evaporation. This, however, is not usually practised. It is generally drawn off from the clarifier into a copper *boiler*, where it is evaporated and skimmed. It is then passed successively through a series of boilers, the last of which is called the *teache*. When it has acquired a proper tenacity and granular aspect, it is emptied or “skipped” first into a copper cooler and afterwards into a wooden vessel, where it is allowed to crystallize or *grain*. The concrete sugar is then placed in casks (usually sugar hogsheads) perforated with holes in the bottom, each of which is partially closed by the stalk of a plantain leaf. Here the sugar is allowed to drain for three or four weeks. It is then packed in hogsheads and sent to this country under the name of *muscovado* or *raw sugar*.

The drainings, or uncrystallized portion of sugar, constitute *molasses*. This is received in an open cistern beneath.

The feculencies separated in the clarifying vessel, and the skimmings of the evaporating coppers, are employed in the manufacture of *rum*.

PROPERTIES OF RAW SUGAR.—Raw sugar is a mixture of crystallizable and uncrystallizable sugar, contaminated by various organic and mineral substances. Its mineral constituents are, according to Avequin, silica, phosphate and subphos-

¹ *Ann. de Chim.* lvii. 131.

² *Journ. de Pharm.* t. xxvi. p. 154, 1840.

³ *Ann. de Chim. et de Phys.* 3me Sér. t. xi. p. 39.

⁴ *Journ. de Chim. Méd.* t. ii. 2de Sér. p. 26, 1836.

⁵ *Ibid.*, p. 248, 1840.

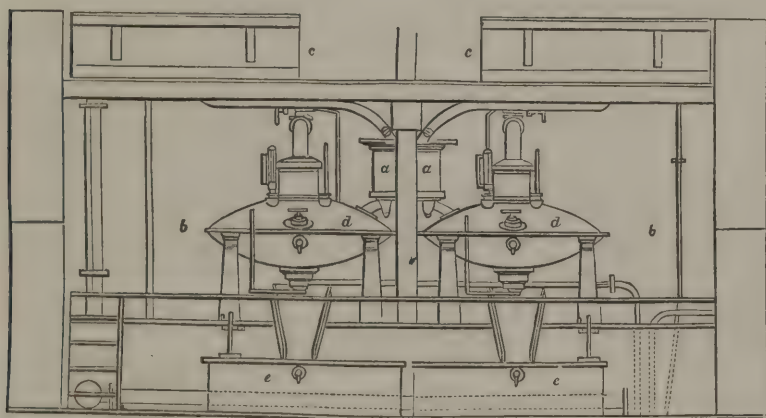
⁶ See Dr. Evans's *Sugar-Planter's Manual*.

phate of lime, carbonate of lime, sulphate of potash, chloride of potassium, and the acetates of potash and lime.

The raw sugar of the shops reddens litmus, and is not completely soluble in alcohol. Its aqueous solution yields precipitates with the diacetate of lead, oxalic acid, and caustic ammonia; and is frequently darkened by the addition of the sesquichloride of iron. By keeping, *strong* raw sugar becomes *weak*—that is, soft, clammy, and gummy. This change the late Mr. Daniell¹ ascribed to the action of the lime.

SUGAR REFINING.—The following is a sketch of the process as usually practised in London: Raw sugar is dissolved in water by the aid of steam (this process is called giving the sugar a *blow-up*). The liquid is then heated with bullock's blood² (technically called *spice*), and filtered through canvas bags (called *Schröder's bags*). The clear liquor is allowed to percolate slowly through a bed of coarse-grained animal charcoal placed on a woollen cloth, supported on a false bottom of basket-work, and contained in a large wooden vessel. The depth of the bed of charcoal varies in different refining-houses. I have seen it three feet deep; but I am told that some refiners employ a bed twenty feet in depth. The filtered liquor, which is nearly colourless, is conveyed to a copper vessel (Howard's *vacuum-pan*), where it is boiled by the aid of steam, under diminished atmospheric pressure, at a temperature of about 170° F.

Fig. 215.



View of two Vacuum Pans and their subsidiary Apparatus.

a a. Charging measures, supplied by pipes, which descend from *c c*, the liquor cisterns. *d d*, are the vacuum spheroidal pans, the lower half of each being supplied with a jacket, as a case for the steam. At the sides of the neck of each pan are a barometer and thermometer. Below the neck, and just above the horizontal line *b b*, is the handle of the proof-stick, which appears like a stop-cock. When the syrup is sufficiently concentrated, it is discharged into the heater, *e e*.

The consistence of the liquid is examined from time to time by taking out a sample by the *proof-stick*, which is so constructed as not to admit air.

When the requisite degree of concentration has been attained, a valve is opened in the bottom of the vacuum pan, and the syrup allowed to escape into a copper vessel (*heater*), enveloped by a jacket, so as to enable it to be heated by steam. The syrup is then transferred to conical moulds (made of earthenware or iron), whose orifices are closed by a paper plug, and the next morning, when solidified, these moulds are carried to the *curing-floor*, when the stoppers are withdrawn and

¹ *Quarterly Journal of Science*, vi. 34.

² At one time hydrate of alumina, under the name of *finings*, was used in addition to blood.

the moulds placed in pots, in order to allow the *green syrups* to drain off: these are made into an inferior sort of refined sugar (*brown lumps*). The loaves are then either *clayed* or *sugared*, generally the latter.

*Claying*¹ (which is now almost entirely out of use) consists in pouring clay and water on the base of the sugar loaf: the water slowly percolating through the sugar, a portion of which it dissolves, carries with it the colouring matter and other impurities. *Sugaring* is effected by substituting a saturated solution of pure sugar (called *liquor*) for the clay and water; it washes out the colouring matter, but does not dissolve the pure sugar. The loaves are afterwards dried in a stove, and put in blue paper for sale.²

The following may be regarded as an approximation to the produce of 112 lbs. of raw sugar by the above process:—

Refined sugar	79 lbs.
Bastard	17
Treacle	16 (12 lbs. solid matter.)
Water	4
Raw sugar	112

The animal charcoal used in sugar refining is changed every week, and of course is a more powerful decolorizer when fresh than when it has been used several times. It follows, therefore, that the quality of the refined sugar obtained varies with the day of the week—that is, with the age of the charcoal. At the commencement of the week, when the charcoal is fresh, the finest white *loaves* of sugar are made; about the middle of the week *titlers* and *lumps* are obtained; and, at the end of the week, *bastards*.

In the process of sugar refining, various salts have been proposed to be used as defecators: such as the trisacetate of lead,³ acetate of lead,⁴ bisulphite of lime,⁵ sulphate of tin,⁶ &c. The salts of lead are probably the most effective agents, but, on account of their poisonous properties, are dangerous to the public health.⁷

PROPERTIES.—Common or cane-sugar is the sweetest of all kinds of sugar. When pure, it is white and odourless. It is very soluble in water, both hot and cold (see *Syrupus*, vol. i. p. 153); is soluble in rectified spirit, but not in ether. Its watery solution, aided by heat, decomposes some of the metallic salts (as those of copper, mercury, gold, and silver); but several of them (as the diacetate of copper and nitrate of silver) require nearly a boiling temperature to change them. A dilute watery solution of common sugar, with a little yeast, undergoes the vinous fermentation. Sugar promotes the solubility of lime in water, and forms both a soluble and an insoluble compound with oxide of lead.

Cane-sugar is capable of existing either in the crystallized or amorphous state. In this respect it resembles sulphur (see vol. i. p. 355).

1. *Crystallized Cane-sugar*.—To this division are referred sugar-candy and the ordinary loaf and lump sugar of the shops. By the slow cooling of a saturated aqueous solution of sugar, we obtain the large and fine crystals which constitute the commercial *sugar-candy* (*saccharum candum*), and of which three kinds are kept in the shops; namely, *white candy*, prepared from pure sugar; *brown candy*, prepared from brown sugar; and *pink* or *rose candy*, prepared from sugar artificially coloured (probably by cochineal).

The crystals of sugar are doubly oblique prisms, and, therefore, have two axes of double refraction⁸ (see vol. i. p. 187). Their sp. gr. is 1.6065.

Common crystallized sugar is permanent in the air and phosphorescent in the

¹ "Claying sugar, as they report here, was first found out in Brazil: a hen, having her feet dirty, going over a pot of sugar by accident, it was found under her tread to be whiter than elsewhere."—Sloane's *Jamaica*, vol. i. p. 61.

² For further details, consult a paper by Messrs. Guynne and Young, *Brit. Ann. of Med.* June 23 and July 14, 1837; also, Dr. Ure's *Dict. of Arts*, art. Sugar.

³ Guynne and Young, *British Annals of Medicine*, vol. i. p. 778, and vol. ii. p. 42, 1837.

⁴ Sievier and Seoffern, *Pharmaceutical Journal*, vols. ix. and x.

⁵ Melsen, *Pharmaceutical Journal*, vol. ix. p. 220.

⁶ Warburton, *Pharmaceutical Journal*, vol. x. p. 82.

⁷ See *Pharmaceutical Journal*, vol. x.

⁸ Sugar-candy makes an interesting polariscope object. It is usually cut so as to show one only of its two systems of rings.

dark when struck or rubbed. When heated, it melts and soon becomes coloured. By this process, its tendency to crystallize is diminished or destroyed.

The commercial varieties of common crystallized cane-sugar are of two kinds—*white* or *brown*. The first is refined sugar.

1. **PURIFIED OR REFINED SUGAR** (*Saccharum*, L.; *Saccharum purum*, E.; *Succus concretus purificatus*, D.; *Saccharum purificatum*) is met with in the shops in conical loaves (*loaf sugar*) or truncated cones, called lumps (*lump sugar*), of various sizes and degrees of purity. Small lumps are called *titlers*. The finest refined sugar (*saccharum albissimum*) is perfectly white, and is termed *double refined*; the inferior kind (*saccharum album*) has a slightly yellowish tint, and is called *single refined*. Both varieties are compact, porous, friable, and made up of small crystalline grains.

2. **BROWN SUGAR** (*Saccharum commune*, E.; *Saccharum fuscum*; *Succus concretus non purificatus*, D.) occurs in commerce in the form of a coarse powder composed of shining crystalline grains. It is more or less damp and sticky, and has a peculiar smell and a very sweet taste. Its colour is brownish-yellow, but varying considerably in intensity. *Muscovado*, or *raw sugar*, has the deepest colour, and is intermixed with lumps. *Bastard* is a finer kind, prepared from molasses and the green syrups. The *Demerara crystal sugar* is the finest: its colour is pale yellow, and its crystals are larger and more brilliant than the preceding varieties.

2. **Amorphous Cane-sugar**.—When syrup or a strong solution of crystallized cane-sugar is rapidly boiled down, and then poured out on a marble or metallic plate, it congeals in an amorphous, vitreous, more or less coloured mass, usually called *boiled sugar*, of which *barley-sugar* (*saccharum hordeatum*), *acidulated drops*, and *hard-bake*, are familiar examples. During the preparation of barley-sugar and acidulated drops, the confectioners usually add a small quantity of cream of tartar to the melted sugar, in order to destroy its tendency to crystallize. Vinegar and tartaric acid are mentioned by some writers as being used for this purpose.

If when the melted sugar has partially solidified, but while it is yet soft, it be hung on a hook and rapidly and repeatedly drawn out, it becomes opaque and white. This *pulled sugar* was formerly termed *sugar penides* (*saccharum penidium*).

When crystallized cane-sugar is subjected to a temperature of about 356° F., it melts; and, at a higher temperature, begins to give off water and to suffer decomposition. If the heat be gradually augmented, it becomes brown, evolves a remarkable odour, loses its sweet taste and acquires a bitter one. In this condition it is called *caramel* (from *καίω*, *I burn*, and *μέλι*, *honey*), or *burnt sugar* (*saccharum tostum*). It enjoys acid properties, and is composed, according to Peligot,¹ of C²⁴H¹⁸O¹⁸.

Molasses and Treacle.—These are viscid, dark brown, dense liquids, composed of amorphous or uncrystallizable sugar, crystallizable sugar, gum, extractive, various salts, and water. They are frequently confounded, but in trade are considered distinct.

1. **MOLASSES** (more correctly *Melasses*, from *mel*, honey, because it is soft and sweet like honey) is the drainings from raw or muscovado sugar. *West India molasses* is occasionally imported for refining. It yields brown sugar, or *bastard*, and *treacle*.

2. **TREACLE** (*Theriaca*, D.; *Fæx Sacchari*, L. E.) is the viscid, dark brown, uncrystallizable syrup which drains from refined sugar in the sugar moulds. It is thicker than West Indian molasses, and has a somewhat different flavour. Its sp. gr. is generally 1.4; and it contains, according to Dr. Ure, on an average, 75 per cent. of solid matter. Payen says that it may be regarded as a saturated solution of crystallizable sugar, of which it contains from 40 to 50 per cent. of its weight. It is employed in the manufacture of gingerbread, and, by poor people, as a substitute for sugar. It is also sometimes used to yield, by fermentation, an alcoholic liquor—either to be drank as a kind of beer, or to yield, by distillation, spirit. It is sold under the names of "*mélasse de la Cochinchine*" and "*prepared melasse*," to be taken with lentilmeal (sold as *ervaleuta* or *revalenta arabica*), as a remedy for habitual constipation.

CHEMICAL CHARACTERISTICS.—As a species of sugar,² cane-sugar is known by its susceptibility of undergoing the vinous fermentation; that is, of suffering a peculiar decomposition into alcohol and carbonic acid. For this purpose it is dissolved

¹ Peligot, *Ann. Chim. et de Phys.* lxxvii. p. 175.

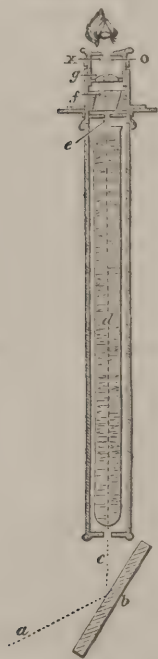
² Mannite, glycyrrhizin, glycerine, and some other sweet substances, which were formerly called sugars, are, by modern chemists, excluded from the list of sugars, properly so called, because they are incapable of undergoing the vinous fermentation.

in water, and to the solution a small portion of yeast (dry yeast is to be preferred) is added, and the mixture exposed to a temperature of about 70° F. Effervescence soon takes place, carbonic acid is evolved, and a vinous or alcoholic liquor is produced. In this process the cane-sugar combines with water, and becomes grape-sugar, $C^{12}H^{12}O^{12}$, which, by fermentation, is resolved into four atoms of carbonic acid, $4CO^2$, and two atoms of alcohol, $2C^2H^6O^2$.

The quantitative determination of sugar is effected by ascertaining the amount of carbonic acid evolved during fermentation. 171 grains of sugar-candy furnish 88 grains, or about 186.4 cubic inches of carbonic acid gas. At mean temperature and pressure, 100 cubic inches, or 47.2 grains, of carbonic acid gas are given out by 91.7 grains of sugar-candy. In round numbers, we may say that one cubic inch or half a grain of carbonic acid gas is equal to one grain of sugar-candy.¹

Cane-sugar is distinguished from other kinds of sugar by the following characters:—Its crystallizability in prismatic crystals, its very sweet taste, its ready solubility in water, its solution being charred and letting fall a brown or black powder when heated with a few drops of oil of vitriol, but being unchanged when treated in the same way with caustic potash—and by the difficulty with which it reduces the blue hydrated oxide of copper to the orange suboxide.

Fig. 216.



Plan of the Apparatus for showing the circular polarization of liquids.

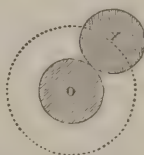
(In this figure, *g* indicates a lens which is used to produce well-defined images.)

Grape-sugar reduces the hydrated oxide of copper to the suboxide with great facility. The test is applied thus: Add to the saccharine solution a small quantity of a solution of caustic potash, and then a few drops of a weak solution of sulphate of copper; taking care that the alkali is in excess. Then apply heat: if grape-sugar be present, an ochre-yellow or red precipitate of suboxide of copper is formed before ebullition takes place. Uncrystallizable sugar, as well as sugar of milk, also readily reduces the oxide; but this effect does not take place with crystallizable cane-sugar; or rather, a higher temperature or a longer action of the ingredients is required to produce the effect. This is called *Trommer's test*.

A solution of crystallizable cane-sugar is distinguished from solutions of some other kinds of saccharine matters by possessing the property of *right-handed circular polarization*.

If a ray of common light (Fig. 216, *a*) be polarized by reflection at an angle of $56^{\circ}.45$ from the surface of glass^a (*b*), the plane polarized ray (*c*), which is thus obtained, transmitted through a pure solution of crystallizable cane-sugar (*d*), and the emergent ray (*e*) ana-

Fig. 217.



Representation of the two disks of complementary colours produced respectively by the ordinary and extraordinary rays. By the rotation of the analyzer, the extraordinary image (*x*) revolves around the ordinary image (*o*), each undergoing a change of colour.

lyzed by a double refracting rhomb of calcareous spar (*f*), two coloured images are perceived (Figs. 216 and 217); one (*o*) caused by ordinary refraction, the other

¹ Full directions for the quantitative determination of sugar by fermentation are given by Dr. Miller, in the article *Organic Analysis* of the *Cyclopædia of Anatomy and Physiology*, vol. iii. p. 799.

² The plane polarization of the ray may be effected by a Nicol's prism instead of a glass-mirror. The use of a silvered glass-mirror is objectionable, on account of its producing elliptical polarization.

(x) by extraordinary refraction. The colours of the images are complementary; that is, when one image is red, yellow, or blue—the other is green, violet, or orange. By rotating the analyzer (the rhomb of calcareous spar), the colours change: if the rotation be right-handed (that is, as we turn a screw or corkscrew to make it enter), the sequence of the colours is red, orange, yellow, green, blue, indigo, and violet.

SEQUENCE OF COLOURS FOR A SOLUTION OF CRYSTALLIZABLE CANE-SUGAR, AS OBTAINED BY THE RIGHT-HANDED ROTATION OF THE ANALYZER.

Ordinary Image.	Extraordinary Image.
Red	Green.
Orange	Blue.
Yellow	Indigo.
Green	Violet.
Blue	Red.
Indigo }	Orange.
Violet }	Yellow.
Red	Green.

In one complete revolution of the analyzer, each of the colours of the spectrum occurs twice for each image.¹

COMPOSITION.—The following is the ultimate composition of sugar:—

	Atoms.	Eq. Wt.	Per Cent.		Atoms.	Eq. Wt.	Per Cent.
Carbon	12	72	47.05	Anhydrous sugar . .	1	153	89.47
Hydrogen	9	9	5.9	Water	2	18	10.53
Oxygen	9	72	47.05				
Anhydrous sugar ² . .	1	153	100.00	Crystallized sugar . .	1	171	100.00

ADULTERATION; PURITY.—The purity of genuine sugar is readily judged of by its physical or sensible qualities. The impurities may also be detected by chemical means, but it is rarely necessary to resort to these. A solution of pure sugar is colourless, and yields no precipitate with oxalic acid, diacetate of lead, or caustic ammonia. Pure sugar is completely soluble in rectified spirit.

Brown sugar of commerce contains crystallizable and uncrystallizable sugar, woody tissue of the sugar-cane, vegetable albumen, siliceous particles, sporules and filaments of fungi; and, in most samples, a peculiar species of mite (*Acarus*), which has been called the *sugar mite*³ (*acarus sacchari*). In most cases the animal is dead, but frequently it is met with in the living state. Starch or flour is also said to be found in brown sugar.

Various adulterations have been practised on sugar. The most important of these is the intermixture of *starch sugar*. A few years ago I inspected an extensive manufactory of sugar from potato-starch at Stratford, in Essex: the sugar obtained was sold for the adulteration of brown sugar, and the molasses produced was consumed in an oxalic acid manufactory. Brown cane-sugar adulterated with starch sugar is less sweet, less readily soluble in water, and less crystalline and sparkling than pure brown cane-sugar. Moreover, potato-sugar always contains sulphate of lime, the detection of which (see the tests for sulphuric acid and lime, pp. 368 and 562) in a suspected sample of sugar is, therefore, of some value. It has been proposed to detect the presence of potato-sugar by Trommer's test (see *ante*, p. 150) and by caustic potash. But though Trommer's test readily detects starch-sugar in a solution of white cane-sugar, the detection is not so easily effected by it in a solution of brown cane-sugar, because the uncrystallizable cane-sugar, or treacle, which

¹ The nature of the present work does not admit of a further elucidation of circular polarization, which I have here introduced as an aid in the qualitative determination of a saccharine solution. Biot has applied it to the quantitative determination of sugar. To his various papers contained in the *Mémoires de l'Académie des Sciences*, and especially to his *Instructions Pratiques sur l'Observation et la Mesure des Propriétés Optiques appellées rotatoires*, Paris, 1845, the reader is referred for further information. See, also, the article *Saccharimétrie Optique*, in Pelouze and Fremy's *Cours de Chimie Générale*, t. iii. p. 337, 1850.—A popular sketch of the subject will be found in my *Lectures on Polarized Light*, published by Messrs. Longman and Co.—A very admirable report on this and other methods of effecting the qualitative and quantitative analysis of sugars, syrups, and molasses, by Professor R. S. McCulloch, is contained in a *Letter from the Secretary of the [United States] Treasury to the United States Senate*, read Feb. 21, 1845.

² Peligot, *Ann. de Chim. et de Phys.* lxvii. p. 124.

³ *Pharmaceutical Journal*, vol. x. pp. 343 and 396, Jan. and Feb. 1851; *Lancet* for Jan. 18 and 25, 1851.

is present readily reduces the blue hydrate of copper to the orange suboxide—acting thus like starch-sugar. Chevallier¹ proposes to detect starch-sugar in cane-sugar by means of caustic potash: Boil the suspected sugar in a ley of caustic potash: if no starch-sugar be present, the liquor remains colourless; but, on the contrary, it becomes brown if starch-sugar be present. But this test, like the last one, is better adapted for detecting starch-sugar in white cane-sugar than in the ordinary brown cane-sugar of the shops.²

Farinaceous substances and dextrine may be detected by boiling the suspected sugar in water and testing the decoction, when cold, with iodine, which causes a blue colour with starch and a purplish colour with dextrine.

Gum is distinguished from sugar by its insolubility in rectified spirit.

Various other substances have, it is said, been used for the adulteration of sugar; as finely-powdered marble, chalk or whiting, sand, bone-dust, and common salt. With the exception of salt, all the substances here mentioned are insoluble in water, and by this character, therefore, may be readily separated from sugar. Common salt may be detected in a solution of the suspected sugar by the ordinary tests for that substance (see vol. i. p. 537).

PHYSIOLOGICAL EFFECTS.—Sugar, considered as an article of food, is an alimentary principle which belongs to the class of “elements of respiration,” (see vol. i. p. 117.) It contributes to the formation of fat and of lactic acid, and by its oxidation furnishes heat. It has recently been detected in the tissue of the liver, but in no other organ.³

It disagrees with some dyspeptics, and is reputed to have a tendency to cause flatulency and preternatural acidity (by the formation of lactic acid?) of the *primæ viæ*.

Treacle, and therefore raw sugar, check the tendency to constipation.

USES.—Sugar is used dietetically, medicinally, and pharmaceutically. *Medicinally*, it is but little employed. In the form of lozenges, sugar-candy, &c., it is slowly dissolved in the mouth to allay tickling cough. As a chemical antidote, it has been recommended in poisoning by the salts of copper, mercury, silver, gold, and lead.⁴ But any advantage procured by its use in these cases is referable to its demulcent and emollient properties, and not to its chemical influence. The same remark may be made with respect to the benefit said to have been obtained by the use of the juice of the sugar-cane in poisoning by arsenious acid.⁵ Powdered white sugar is sometimes sprinkled over ulcers, to remove spongy granulations, denominated proud flesh. The same remedy has also been employed for the removal of specks on the cornea.

In *pharmacy*, the uses of sugar are much more extensive. It serves to preserve, to give flavour, bulk, form, colour, cohesiveness, and consistence; to subdivide and to suspend oily substances in aqueous liquids. To fulfil one or more of these objects, it is a constituent of *syrups*, *elæosacchara*, *conserves*, *electuaries*, *confections*, *lozenges*, some *pills* and *powders*, &c. For making pills, treacle serves to give cohesiveness, to preserve the pill-mass soft, prevent mouldiness, and in some cases to check chemical changes. As an antiseptic, it is used for the preservation of various medicinal organic substances. It acts in at least two ways—by excluding air and by absorbing moisture (see vol. i. p. 205); and perhaps, also, in some other way—as when it promotes the solidification of pectine. Sugar is also useful in preserving some inorganic compounds: thus it checks, though it does not absolutely prevent, the higher oxidation of some of the protosalts of iron; hence its

¹ *Journ. de Chim. Méd.* t. viii. 2de Sér. p. 472, 1842.

² On a trial for the recovery of excise duties on potato-sugar, it was stated that this sugar possessed only three-fifths of the sweetening properties of genuine cane-sugar, and that it was mixed with whiting, bone-dust, &c. previous to its being offered for sale. (*Pharm. Journ.* vol. i. p. 603, 1842.)

³ *Comptes rendus*, xxvii. p. 514; *Chemical Gazette*, March 1, 1849.

⁴ Vogel and Buchner, in *Schweigger's Journ.* xiii. 162; xiv. 224.

⁵ Chisholm, *Quarterly Journal of Science*, x. 193.

use in the *ferri carbonas saccharatum* (see vol. i. p. 724), and *syrupus ferri iodidi* (see vol. i. p. 744).

It is employed in the manufacture of oxalic acid; and it is sometimes used in distilleries to yield, by fermentation, alcohol. The Edinburgh College directs it to be used in the rectification of sulphuric acid (see vol. i. p. 359).

As a test, it is sometimes used in the laboratory in conjunction with oil of vitriol, to detect the cholic acid of bile.

1. SYRUPUS, L. [U.S.]; *Syrupus simplex*, E. D.; *Syrup*; *Simple Syrup*.—(Sugar ℥iij [℥v, D. (℥iiss, U. S.)]; Water Oj [Oij, D. (Oj, U. S.)]. Dissolve the sugar in the water by a gentle heat.)—By keeping for several months, syrup undergoes some molecular changes, by which its power of producing right-handed circular polarization is considerably diminished.

The proportion of water and sugar used by the London College is, by weight, water 1 part, sugar 1.9748 parts; by the Edinburgh College, water 1 part, sugar 2.1942 parts—or, very nearly, water 1 part, sugar $2\frac{1}{5}$ parts; and, by the Dublin College, water 1 part, sugar 2 parts.

In order to yield a clear and bright syrup, distilled water and well-refined sugar should be employed. Ordinary spring water becomes turbid by boiling, owing to the precipitation of carbonate of lime.¹

The sp. gr. of boiling syrup should be 1.264 (equal to 30° of Beaume's areometer). When it has cooled down to 60° F., its sp. gr. should be 1.321 (equal to 35° of Beaume's areometer). The Dublin College states the sp. gr. of simple syrup to be 1.330.

Syrup is used in medicine to give flavour, cohesiveness, and consistence.

2. LIQUOR SACCHARI TOSTI; *Caramel*; *Burnt Sugar*.—This is a useful, innocuous colouring agent. It is prepared by melting half a pound of brown sugar in an iron pot, and applying heat until the liquid acquires a deep brown colour; then adding a gallon of boiling water.

41. *Andropogon muricatus*, Retz.—*Vittie-Vayr*, or *Cuscus*.

Sez. Syst. Triandria, Digynia.
(Radix.)

Virana, Asiat. Res. iv. 306; *A. squarrosus*, Linn., Suppl. 433; *Phalaris zizanoides*, Linn., Syst. Veg. v. 104; *Anatherum muricatum*, Beauv., Agrost. 128, t. xxii f. 10; *Vetiveria odorata*, Virey, Journ. de Pharm. xiii. 499; *Bena* (Bengalee), Roxburgh, Fl. Ind. i. 265; *Vittie-Vayr* (Tamool), Ainslie, Mat. Indica, ii. 470; *Woetiwear* (Tamool), Roxb., op. supra cit.—Coromandel, Bengal: very common on every part of the coast.—Its root, called *cuscus*, or *khus-khus* (*radix vetiveriæ*), is imported from Bombay: it is long, fibrous, brownish or yellowish-white; has a fragrant aromatic odour,² and a feeble bitterish, aromatic taste. Iodine colours it bluish-black. In 1809, Vauquelin³ analyzed it under the name of *schœnanthus*. It was analyzed in 1828 by Henry,⁴ and in 1831 by Geiger;⁵ the latter found volatile oil, resin, bitter extractive, starch, traces of hydrochloric and calcareous salts and woody fibre. Cap⁶ submitted the root to distillation with water, and obtained two volatile oils: one limpid, amber-coloured, and lighter than water; another, in larger quantity, which was heavier than water, opaque, and adhered to the bottom of the receiver. The dried roots, when slightly moistened, emit a pleasant kind of fragrance, and are employed in India for making *vissaries* (large fans) and door- and window-screens (composed of a frame-work of bamboo covered by cuscus root). During the hot winds, the outsides of these screens are kept watered by natives, and the air that passes through is thereby rendered both cool and fragrant. Cuscus root is imported into England for perfumery purposes. It serves to make scented baskets, and is put into drawers to guard linen and woollen goods from the attacks of insects. This root has also been employed in medicine. It acts as a gentle

¹ See some observations by Mr. Savory, on the preparation of syrup, in the *Pharmaceutical Journal*, vol. ii. p. 452, 1843.

² The odour is said by Martius (Buchner's *Repertorium*, Bd. xxxix. S. 230, 1831) to be between that of galbanum and of violet-root, and to approach that of serpentary; while Geiger considers it to be between that of culamum and of yellow water iris-root, and similar to myrrh.

³ *Ann. du Mustum*, xiv. 28; and *Ann. de Chimie*, lxxii. 302.

⁴ *Journ. de Pharm.* tom. xiv. p. 57, 1828.

⁵ Quoted by Goebel, *Pharm. Waarenkunde*, Bd. ii. S. 265.

⁶ *Journ. de Pharm.* t. xix. p. 48, 1833.

excitant and diaphoretic. In India, an infusion of it is used as a diaphoretic and gentle stimulant in febrile cases. The warm infusion has been employed as an antispasmodic, diaphoretic, diuretic, and emmenagogue. An ointment of the root has also been applied to destroy pediculi on the heads of children.¹ In 1831, it was used in Paris as a preservative against the cholera; it was worn by the ladies; bundles of it were hung up in the rooms; and fumigations were prepared with it.² In Hamburg, it was used by Dr. Buchheister³ and others in cholera. A weak infusion has been used by Foy⁴ in rheumatism and gout. It may be employed in the form of powder, infusion, tincture, or volatile oil. The dose of the powder (*pulvis vetiveria*) is about a scruple in the form of pills. A weak infusion or tea is prepared with one or two drachms of the root and two pints of water; this may be drank *ad libitum*. A strong infusion, prepared with one ounce of the root to half a pint of water, may be administered in doses of a tablespoonful. A tincture (*tinctura vetiveria*), made with one ounce of the root and half a pint of proof spirit, is given in doses of a teaspoonful.

42. *Andropogon Iwarancusa*, Roxburgh.

Sex. Syst. Triandria, Digynia.

(Radix.)

Ibharankusha, *Iwarankusha*, *Kurankusha*, Beng. and Hind.; *Iwarancussa*, *Asiat. Res.* iv. 109; *Terancus*, Blane, *Phil. Trans.* vol. lxxx. p. 286, 1790; Sir G. Blane considered that it might be the *Nardus Indica*, or *Spikenard*, of the ancients: Mr. Hatchett supposed it to be the source of the grass oil of *Nemaur*, an opinion which Dr. Royle⁶ has declared to be incorrect.—This fragrant grass, which has a bitter, warm, pungent taste, is a native of the skirts of the northern mountains of India; between the river Rapti and the northern mountains, and about Hurdwar. It comes remarkably near *A. Schenanthus* both in habit and taste. It is employed by the natives in fevers, whether continued or intermittent. They infuse about a drachm of it in half a pint of hot water, with a small quantity of pepper, and give this for a dose thrice daily. The virtues almost entirely reside in the larger parts of the roots, marked with annular cicatrices.

43. *Andropogon Calamus aromaticus*, Royle.

Sex. Syst. Triandria, Digynia.

(Oleum volatile.)

According to Dr. Royle,⁷ the grass-oil of *Nemaur* is obtained from a new species of *Andropogon*, to which he has given the name of *A. Calamus aromaticus*. He says that it is "found in Central India, extends north as far as Delhi, and south to between Godavery and Nagpore, where, according to Dr. Malcolmson, it is called *spear-grass*: it may be the *A. Martini* of Roxburgh, as, I believe, it is also thought to be by Dr. Wight, though it has been named *A. Nardoides* by Nees von Esenbeck." Dr. Royle examined Mr. Hatchett's specimens of the grass, obtained from Mr. Swinton, as the source of the grass-oil, and found them to be identical with his *A. Calamus aromaticus*, though Mr. Hatchett's figure of the plant (copied from the *Phil. Trans.* vol. lxxx.) actually represents another species, viz., *A. Iwarancusa*. Dr. Wallich⁸ examined a specimen of the plant from which the grass-oil is obtained, and declared it to be either *A. Iwarancusa*, or, perhaps, *A. Martini*, Roxburghi.

Dr. Royle⁹ considers this species to be the *sweet calamus*¹⁰ and *sweet cane*¹¹ of Scripture—the *κάλανος ἀρωματικός* of the ancient Greeks.¹²

GRASS-OIL OF NEMAUR; *Roosa-ke-tel*, Hind.; *Oleum graminis Indici*.—This oil is imported from India under the name of *grass-oil* or *ginger-grass oil*.¹³

In 1845, I obtained from a merchant in London a sample of essential oil which agreed in its sensible qualities with the grass-oil of *Nemaur* given me by Dr. Royle. With it I received the following notice: "A sample of three canisters of essential oil imported from Bombay, under the name of *ginger-grass oil*, and, according to the importer, used by the natives against rheu-

¹ Lemaire Lignacourt, *Bull. de la Soc. Phil.* vii. 43, 1822.

² Kunze, *Pharm. Central Blatt fur* 1831, S. 660.

³ Dierbach, *Die neuest. Entd. in d. Mat. Med.* Bd. i. S. 166, 1837.

⁴ *Bull. gén. de Thérap.* Fev. 1834.

⁵ *On the Spikenard of the Ancients*, [by C. Hatchett, F.R.S. Lond. 1836, 4to.]

⁶ *Essay on the Antiquity of Hindoo Medicine*, pp. 34 and 82.

⁷ *Essay on the Antiquity of Hindoo Medicine*, pp. 33 and 82, 1837; and *Illustrations of the Botany, &c. of the Himalayan Mountains*, p. 425, 1839.

⁸ *Transactions of the Medical and Physical Society of Calcutta*, vol. i. p. 368, Calcutta, 1825.

⁹ In Kitto's *Cyclopædia of Biblical Literature*, vol. ii. p. 195, 1845.

¹⁰ *Exodus*, ch. xxx. ver. 23. It is here called *Kaneh Bosem*, literally *reed of fragrance*.

¹¹ *Jeremiah*, ch. vi. ver. 20. It is here denominated *Kaneh Hattob*, or *good reed*.

¹² Dioscorides, lib. i. cap. 17.

¹³ Ainslie (*Mat. Indica*, vol. ii. p. 401) applies the names of *ginger-grass*, *spice-grass*, *false spikenard*, *sukunaro-pilloo* (Tampool), to the *Andropogon Nardus* (?) of Dr. Rottler, which he says is common in the Cautalum hills and in the Tinnevely district; but he puts a query whether it may not be the fragrant grass described by Mr. Maxwell in the *Transactions of the Medical Society of Calcutta*, vol. i. p. 367, 1825.

matism, and by them called *rosa oil*. The grass grows, according to the same authority, fifty or sixty miles from Bombay in the jungle, and is there called *rosa grass*. It smells, as you will perceive, of ginger and turpentine.¹

Grass-oil of Nemaur is commonly known to the perfumers by the name of *oil of geranium*. I have been informed that it is sometimes called *oil of rose geranium*. It is occasionally sold by druggists as *oil of spikenard*.

Under the name of "*Ol. Palm, ros,*" [sic.] a volatile oil has been sent from a merchant in Constantinople to his correspondent in London, as an oil used for reducing (that is, adulterating) otto of roses; and, in the accompanying letter, it was stated that if genuine otto be mixed with from 20 to 30 per cent. of this oil, it would be still equal to the finest commercial otto. By the dealers in London this oil was called *oil of geranium*.² It is almost colourless, and is clearer, brighter, and more fragrant and roseate than ordinary grass-oil; but its odour is, I think, essentially that of the latter. Is it rectified grass-oil? It is remarkable that Dioscorides (lib. i. cap. xvi.) states that *σχοῖνος* (a native of Arabia) has the odour of the rose.

Grass-oil of Nemaur is, according to Mr. Forsyth,² procured at the foot of the Vindhya range of hills in the vicinity of Jaum Ghat, and thirty miles further west, near Nalcha.

It is obtained by distillation. When the plant begins to flower, it is cut and bound in small bundles or maniples, 250 or 300 of which are introduced into a wrought-iron boiler fitted over an earthen fireplace. Water being added, ebullition is promoted. The oil, with water, distils over into two large copper receivers immersed in cold water. The process occupies about six hours. After the product has stood for some time, the oil is skimmed off the surface by a small shallow spoon.

Commercial grass-oil of Nemaur is of a light straw colour, and has a fragrant aromatic roseate odour, with taste which is not very dissimilar to that of oil of lemons. It floats on water. Dr. Stenhouse³ found that it is usually a mixture of a pure volatile oil (C^4H^5), and of about half its bulk of a fluid resin, the latter probably being the product of the oxidation of the oil.

In India, the grass-oil is frequently adulterated; usually, according to Mr. Forsyth, with the *ol. sesami*. As this is a fixed oil, the sophistication is readily detected by dropping the suspected grass-oil into rectified spirit: if pure, it dissolves, but if it be mixed with a fixed oil, the spirit becomes milky.

Grass-oil is chiefly employed in perfumery; but it is also employed in medicine. Its medicinal properties are similar to those of other aromatic fragrant volatile oils, and are those of a stimulant and diaphoretic. It is highly esteemed in India for the cure of the more chronic forms of rheumatism. It is applied as a liniment. A couple of drachms of it are rubbed into the affected part in the heat of the sun, or before the fire, twice daily. It causes a sense of warmth and pricking which lasts for two hours or longer. It is also employed to excite diaphoresis in slight catarrhal affections; and for this purpose it is rubbed into the soles of the feet and wrists.

44. *Andropogon Schœnanthus*, Linn.

Sex. Syst. Triandria, Dignia.

I suspect that under this name three species of *Andropogon* have been confounded.

1. Rumphius's *Schœnanthum Amboinicum*, called by the natives of Amboyna *Siree*. Its odour is that of a mixture of roses and fresh-mown hay. As Linnæus, in the later editions of his *Systema Plantarum*, cites Rumphius's figure,⁴ we may take this species as the genuine *Andropogon Schœnanthus* of Linnæus.⁵ It has been recently very fully described by the late celebrated Professor Th. F. L. Nees von Esenbeck.⁶ Rumphius proposes to call it *Schœnanthum Indicum sterile*, to distinguish it from the Arabian plant.

2. The Arabian *Schœnanthus* is said by Hasselquist⁷ to grow plentifully in the deserts of both the Arabias, and to be gathered near Limbo, a port of Arabia Petræa, and exported to Egypt. The Arabians call it *Helsi Meccavi* and *Idhir Mecchi*. It is said that in the deserts between Syria and Egypt there is no grass but this which camels eat: hence it has received the name of *fanum* vel *stramen camelorum*, or *camel's hay* or *straw*. It was formerly in the London Pharma-

¹ Recluz (*Journ. de Pharm.* t. xiii. p. 520, 1827) obtained from *Pelargonium odoratissimum*, var. *odore rosato* (Persoon), a concrete volatile oil, which he calls *volatile oil of geranium with the odour of the roses* (*huile volatile du Géranium à odeur de roses*). It must not be confounded with the so-called oil of geranium alluded to in the text.

² *Transactions of the Medical and Physical Society of Calcutta*, vol. iii. p. 213, Calcutta, 1827.

³ *Memoirs and Proceedings of the Chemical Society of London*, vol. ii. p. 122, 1845.

⁴ *Herbarium Amboinense*, pars v. lib. viii. cap. 24, page 181, tab. lxxii. Fig. 2.

⁵ In the *Linnean Herbarium*, there is a single specimen of *A. Schœnanthus*, but without any statement indicating its place of growth.

⁶ *Geiger's Pharmacie*, 2te Aufl. von Th. F. L. Nees von Esenbeck, J. H. Dierbach, und Cl. Marquart, Bd. II. Heft 1, S. 145, 1839.

⁷ *Voyages and Travels in the Levant in the years 1749, 50, 51, 52*, Lond. 1766.—It is remarkable that Forskål, in his *Flora Arabico-Yemen*, does not mention, in his list of odorous plants (p. xcv.), a single odorous grass as growing in Arabia Felix.

copœia, and was called *schœnanthus*, *squinanthus*, vel *juncus odoratus*; its vernacular name being *squinanch* or *sweet-smelling rush*. The herbs (stem, leaves, and sometimes the flowers) were brought from Turkey and Arabia, tied up in bundles about a foot long. The stem, which resembled a barley straw, was filled with a pith like those of our common rushes; the flowers were of a carnation colour, striped with light purple.¹

It was considered to possess stimulant and diaphoretic properties, and was commended in hiccup, vomiting, flatulent colic, and female obstructions; but was little used, except in the *mithridatium* and *theriaca*. It was administered to the extent of one or two drachms in the form of infusion or tea.

It is not improbable that this plant may be the *σχοῖνος εὐσπμος* of Hippocrates,² the *σχοῖνος* of Dioscorides;³ for the last-mentioned writer states that the most esteemed sort grew in that part of Arabia called Nabatæa, which agrees with the statement of Hasselquist.

3. The *Andropogon citratus*, De Cand.—As this is undoubtedly the source of the oil of lemon-grass of the shops, it deserves a separate notice.

45. *Andropogon citratus*, De Cand.—Lemon-Grass.

Although all the Anglo-Indian botanists, whose works I have consulted, consider the *Lemon-grass* of India to be identical with the *Andropogon Schœnanthus* of Linnæus, yet various circumstances have long since led me to suspect that they are in error. Its citron or lemon odour is so very strong and remarkable, that any one familiar with the plant, or its volatile oil, could not overlook or mistake it. Yet not one of the authorities quoted by Linnæus, nor any of the pharmacologists of the last century who were familiar with the Linnæan plant, mention it. Rumphius,⁴ whose figure of the plant is referred to by Linnæus, says the odour of the Amboyna plant is similar to that of roses mixed with that of new-mown hay. Dale⁵ describes the odour of *Schœnanthus* as being sweet and very fragrant, and Lewis⁶ simply says it is agreeable.

The first botanical writer who notices the peculiar citron odour of lemon-grass is De Candolle,⁷ who states that under the name of *Andropogon citratus* there was frequently met with in botanical gardens a grass which had very much the habit of *A. Schœnanthus*, but was larger, did not require a hot-house, and was most distinctly characterized by the citron-odour of the bruised leaves. The late eminent botanist professor Th. Fr. L. Nees von Esenbeck⁸ pointed out some botanical characters which distinguish the two plants. Thus he states that the leaves of *A. citratus*, De Cand. are much broader, *flat*, of a strong bluish-green colour, and both above and at the margin are very rough when drawn backwards through the fingers; whereas, the leaves of *A. Schœnanthus* are narrow (half a line in breadth), *completely keeled*, like those of the sedges, bluish-green, and somewhat sharp at the margin when drawn backwards through the fingers. Moreover, the hairs of the rachis of the spikelets of the *A. citratus* are much shorter than those of *A. Schœnanthus*.

Lemon-grass is a native of the continent of India and of Ceylon. It was introduced into the West Indies towards the latter part of the last, or beginning of the present century.⁹

The peculiar characteristic of this species of *Andropogon* is its odour, which, when the grass is fresh, is very distinctly citron-like; or rather, especially when the plant is dry, resembles that of balm—the *Melissa officinalis*, Linn., called by the French *Citronnelle*.

The lemon-grass yields, by distillation, an essential oil, which is imported from Ceylon, Bombay, Cochin (Malabar coast), and Madras, under the names of *lemon-grass oil* or *citronnelle oil*. It is yellow, and has a fragrant, citron-like odour. It is much used in perfumery under the name of *oil of verbenæ*. It is frequently adulterated with a fixed oil, and when thus sophisticated it forms a milky liquid when dropped into rectified spirit; whereas, the pure oil dissolves and yields a transparent solution.

The lemon-grass is employed in the form of infusion, in both the East and West Indies, as a mild diaphoretic in slight colds. The fresh leaves are sometimes used as a substitute for tea, and the white succulent centre of the leaf-bearing stems serves to give an agreeable flavour to curries. In Martinique, it is reputed poisonous, or at least as capable of producing abortion both in animals and the human species.¹⁰

¹ Lewis's *New Dispensatory*, 5th ed. 1785, p. 160.

² *De Morb. Mul.* lib. ii. sect. v. p. 673, ed. Fœsli.

³ *Herb. Amboinense*, pars v. lib. viii. cap. 24, p. 181, tab. lxxii. Fig. 2, Amstel. 1750.

⁴ *Pharmacologia*, 3tia ed. p. 258, 1737.

⁵ *Experimental History of the Materia Medica*, 4th ed. vol. ii. p. 20, 1791.

⁶ *Catalogus Plantarum Horti Botanici Monspeliensis*, p. 78, Monspeli, 1813. Link (*Hort. Berol.* i. 242, 1827), and, following him, Kunth (*Enum. Plant.* i. 493, 1833), in quoting this work, have substituted the name *A. citriodorus* for *A. citratus*: the former name does not occur in De Candolle's Catalogue.

⁷ Geiger's *Pharmacie*, 2te Aufl. by Th. F. L. Nees von Esenbeck, J. H. Dierbach, and C. Marquart, 2te Abth. 1te Hälfte, S. 147, 1839.

⁸ Hamilton, *Pharmaceutical Journal*, vol. vi. p. 369, 1846.

¹⁰ Guibourt, *Hist. Nat. des Drogues Simples*, 4me édit. t. ii. p. 114, 1819.

⁹ Lib. i. cap. 16.

ORDER VII. CYPERACEÆ, *R. Brown.*—SEDGES.

CHARACTERS.—The plants in this order closely resemble grasses (see *ante*, p. 106), from which they are distinguished by their *embryo* being inclosed within the base of the albumen; by their *leaf-sheaths* being whole or entire, not slit; and by their *stems* being solid, angular, and without joints or diaphragms.

PROPERTIES.—These plants are remarkable for their deficiency of those organic principles which render the grasses so valuable and important to man (see *ante*, p. 107). The so-called roots (rhizomes) of several species of *Cyperus* (e. g. *longus*, *rotundus*, and *esculentus*) were formerly employed in medicine. They are mild aromatics, stomachics, and diaphoretics. The roasted roots of *C. esculentus* have been used as a substitute for coffee. The rhizomes of *Carex arenaria* have been employed as a substitute for sarsaparilla, under the name of *bastard* or German sarsaparilla (*radix sarsaparillæ germanicæ vel radix graminis major*).

Sub-class II. *Petaloidæ vel Floridæ.*

CHARACTERS.—Floral envelopes, if present, whorled.

This sub-class includes all the remaining orders of endogens, which may be arranged in two subdivisions.

SUBDIVISION I.

Floral envelopes absent ; or, if present, imperfect, squamiform, sometimes more or less glumaceous.

ORDER VIII. AROIDEÆ, *Endl.*

ARACEÆ and ORONTIACEÆ, *Lindl.*

CHARACTERS.—*Flowers* generally unisexual, rarely hermaphrodite, arranged upon a *spadix*, in the axil of a *spathe*. *Perianth* either none, or, in the hermaphrodite flowers, rudimentary and scaly. *Stamens* numerous, or definite and opposite to the segments of the perianth: *anthers* opening outwards. *Ovaries* free, 1-, 3-, or many-celled. *Fruit* succulent or dry, indehiscent. *Seeds* usually with fleshy or mealy albumen, rarely with none. Usually herbaceous plants with either subterranean tubers (cormi) or a creeping rhizome.

PROPERTIES.—The fresh plants of this order are frequently remarkable for acidity, which especially resides in the tubers and rhizomes, and often renders them violent poisons. This is especially remarkable in *Dieffenbachia Seguina*, or the Dumb Cane, a native of the West India Islands, two drachms of whose juice have been known to prove fatal in two hours. The acrid principle (which, perhaps, may be a sulphurated volatile oil) is in many cases readily dissipated or decomposed and rendered inert by cooking. Even drying seems to injure or destroy it. As it is soluble in water, washing removes it from the starch.

The useful qualities of the order depend on *starch* and *aromatic volatile oil*: on the former depend the esculent properties of some species, and on the latter the medicinal properties of some.

Colocasia esculenta (also called *Caladium esculentum* or *Arum esculentum*) is used in some parts of the world as food. Its large, fleshy, and farinaceous tubers are called *yams* in Madeira, from whence they were sent me by Mr. Nobrega. I find that when boiled they form a very agreeable substitute for potatoes.

Colocasia Antiquorum is cultivated in Egypt and other parts of the world for the nutritious matter yielded by the tubers.

Sub-order I. ARACEÆ, *Endl.*

Flowers naked, unisexual.

46. *Arum maculatum*, *Linn.*—Cuckow-pint.

Sez. Syst. Monœcia, Polyandria.

(Tuber.)

ARUM VULGARE, *Lam.*; *Common Cuckow-pint*; *Wake Robin*; *Lords and Ladies*.—A well-known, indigenous, acrid, and poisonous plant, which, by drying or by the aid of heat, loses its acidity. From the underground tubers is manufactured, in the island of Portland, a starch called *Portland*

arrow-root or *Portland sago* (*fecula ari*; *farina ari*). It is procured by cleansing the roots (tubers), pounding them in a stone mortar with water, and then straining. The starch subsides from the strained liquor, and, the supernatant water being poured off, is collected and dried.¹ Care is requisite in the pounding of the roots on account of their acidity.

From a peck of the roots about a pound of starch is procured.

Portland arrow-root is a white amylaceous powder. Examined by the microscope, its particles are found to be exceedingly small,² circular, mullar-shaped, or polyhedral. The angular appearance of some of them arises from compression. The hilum is circular, and apparently lies in a small depression. It cracks in a linear or stellate manner. The dietetical uses of this starch are similar to those of other starches, as of the West Indian arrow-root. It makes very agreeable puddings.

The roasted tubers are esculent.

The fresh plant is an acrid poison; causing burning and swelling of the throat, vomiting, colic, diarrhœa, and convulsions. By drying, the activity of the plant is in a great measure destroyed. Medicinally, the tubers were formerly used as diuretics in dropsies, and as expectorants in chronic catarrhs.³

47. *Arisæm atrorubens*, Blume.—**Dragon-Root.**

Sex. Syst. Monœcia, Polyandria.

(Tuber.)

ARISEMA ATORRUBENS, Blume, Rumphia, i. 97; *Arum triphyllum*, Linn.; *Dragon-root*; *Indian Turnip*; *Wake Robin*.—A native of the United States of America. Its properties agree closely with *Arum maculatum*, and, like the latter, it yields a pure white fecula. The tuber is used in the United States as a stimulant to the secretions in chronic bronchial affections, rheumatism, &c., in doses of from ten grains to a scruple. The powder, made into a paste with honey, has been beneficially applied to the mouth and throat of children in aphthæ.

Sub-order II. CALLACEÆ, Endl.

Perfect stamens associated with ovaries in hermaphrodite florets.

48. *ACORUS CALAMUS*, Linn.—**COMMON SWEET FLAG.**

Sex. Syst. Hexandria, Monogynia.

(Rhizoma, L.—Rhizome, E.)

HISTORY.—This is probably the *ἀκρον* of Dioscorides.⁴ Dr. Royle says that in Persian works *akoron* is given as its Greek appellation. It must not be confounded with the *κάλανος ἀρωματικός* of Dioscorides, which, according to Dr. Royle,⁵ is *Andropogon Calamus aromaticus*, Royle (see *ante*, p. 154).

BOTANY. *Gen. Char.*—*Flowers* arranged upon a *spadix*. *Spathe* replaced by a two-edged leaf-blade. *Perianth* of 6 pieces or scales, inferior, persistent. *Stamens* 6, filiform. *Stigma* sessile. *Ovaries* 2- 3-celled. *Berries* 1-celled, 1-3-seeded. *Seeds* albuminous.

Sp. Char.—*Spathe*, a continuation of the 2-edged *scape*, rising much above the *spadix*.

Rhizome thick, rather spongy, with many long roots, aromatic, like every part of the herbage, but much more powerfully so. *Leaves* erect, two or three feet

¹ Mrs. Gibbs, *Transactions of the Society of Arts*, vol. xv. p. 238, 1797.

² The following measurements of five particles were made by Mr. Jackson:—

1.	0.0004	of an English inch.
2.	0.0003	“ “
3.	0.00022	“ “
4.	0.00013	“ “
5.	0.0001	“ “

5)0.00115

Average 0.0023

The average size, therefore, is the $\frac{1}{4348}$ th of the inch in diameter.

³ See Murray, *App. Med.* vol. v. p. 44, 1790; and Alston's *Lectures on the Materia Medica*, vol. i. p. 387.

⁴ Lib. i. cap. 2.

⁵ *Essay on the Antiq. of Hindoo Med.* p. 33.

high, bright green, near an inch broad. *Stalk* like the leaves, except being thicker below the *spadix*, and not quite so tall. *Spadix* about a foot above the root, a little spreading, two or three inches long, tapering, covered with a mass of very numerous, thick-set, pale green *flowers*, which have no scent, except when bruised. A very narrow wavy membrane may be observed at the base of the *spadix*, which perhaps ought to be taken into the generic character as a *spathe* (*Smith*).—Perennial: flowers in June.

Hab.—It is a native of this country, growing in watery places about the banks of rivers, and is very plentiful in the rivers of Norfolk, whence the London market was formerly supplied. It grows, also, in other countries of Europe, in Asia, and in the United States.

DESCRIPTION.—The dried underground stem (*rhizoma*, L.; *radix acori veri* seu *radix calami aromatici*, Offic.) occurs in the shops in flattened pieces four or five or more inches long, and about as broad as the thumb; jointed, somewhat curved, of a spongy or corky texture internally; of a yellowish brown or fawn colour externally, and buffy, with a slight roseate hue, internally. Their fracture is short: their upper surface is marked transversely with the vestiges of the leaves which were attached to it; the lower surface has numerous dark points, surrounded by small light-coloured elevated circles, from which the roots arise. Their taste is warm and bitter; their odour is aromatic. In Germany, the rhizome is usually peeled before drying it (*rhizoma decorticata*); but the operation is unnecessary and wasteful. In this state, the rhizome is grayish-white and easily pulverizable.

The rhizome should be gathered in spring or late in the autumn, and dried quickly. It is usually gathered on the banks of the Thames about May for the London market.

The fresh rhizome is employed for distillation. The pieces are sometimes fourteen or fifteen inches long, and one inch wide.

The rhizome of the Yellow Water Iris (*Iris Pseudo-acorus*) is said to be sometimes substituted for that of the true *Acorus*.

COMPOSITION.—The fresh rhizome was analyzed by Trommsdorff,¹ who obtained the following results: Volatile oil, 0.1; soft resin, 2.3; extractive, with a little chloride of potassium, 3.3; gum, with some phosphate of potash, 5.5; starchy matter (like inulin), 1.6; woody fibre, 21.5; and water, 65.7. Meissner found traces of copper in the ashes.

The active constituents are the oil, the resin, and the extractive.

OIL OF THE COMMON SWEET FLAG (*oleum acori calami*, called, in the shops, *oleum calami aromatici*) is obtained by distilling the fresh rhizome with water. Its odour is similar to, though less agreeable than, that of the rhizome. Its colour is yellow. It is bought by snuffmakers, so that it is used, I presume, for scenting snuff. It is also employed in the preparation of *aromatic vinegar*.

CHEMICAL CHARACTERISTICS.—Iodine blackens the rhizome (especially when it has been boiled), thereby indicating the presence of starch. The cold decoction of the rhizome forms, with a solution of iodine, the blue *iodide of starch*. Acetate and diacetate of lead, and protonitrate of mercury, cause precipitates with the decoction. These precipitates consist principally of metallic oxides or subsalts, and the substance called extractive. Nitrate of silver produces a precipitate (*chloride of silver*), which is insoluble in nitric acid, but soluble in ammonia. The decoction reddens litmus.

PHYSIOLOGICAL EFFECTS.—It is an aromatic stimulant and mild tonic. Vogt² arranges it with the *excitantia volatilia*, and regards it as approaching angelica root on the one hand, and cascarilla and angustura barks on the other.

USES.—It is rarely employed by medical practitioners, though it might be frequently substituted, with good effect, for the more costly oriental aromatics. It is a useful adjunct to other stimulants and tonics. It has been employed in continued

¹ Gmelin, *Handb. d. Chem.* ii. 1339.

² *Lehrb. d. Pharmacodyn.* i. 454, 2te Aufl.

asthenic fevers accompanied with much prostration of strength and greatly weakened digestive power. For the cure of ague, the dried root powdered is used by the country people in Norfolk.¹ It is well adapted for dyspeptic cases accompanied with, or dependent on, an atonic condition of the digestive organs, and is especially serviceable in gouty subjects. It has also been used as a local agent, viz., in the formation of aromatic baths, poultices, and gargles, as an application to foul-conditioned ulcers, &c. It is employed, I am informed, by some rectifiers to flavour gin.

ADMINISTRATION.—In *powder*, the rhizome may be given in doses of from a scruple to a drachm. The *infusion* is, perhaps, the most eligible preparation; it is made by digesting 3j of the rhizome in 3xij of boiling water; the dose is two or three tablespoonfuls. The *decoction* is an objectionable preparation, as the oil of the rhizome is dissipated by boiling. The *tincture* (Ph. Bor.) is procured by digesting 3ij of the rhizome in 3xij of spirit (sp. gr. 0.900); the dose is a teaspoonful.

SUBDIVISION II.

Flowers with a proper, often corolline perianth, usually hermaphrodite.

1. Leaves with parallel veins, either proceeding from the base to the apex (*straight-veined*), or curved and proceeding from the midrib to the margin (*curved-veined*).

† Flowers sessile on a branched scaly spadix, usually unisexual.

ORDER IX. PALMÆ, Juss.—THE PALM TRIBE.

PALMACEÆ, Lindl.

CHARACTERS.—*Flowers* hermaphrodite, or frequently polygamous. *Perianth* six-parted, in two series, persistent; the three outer segments often smaller, the inner sometimes deeply connate. *Stamens* inserted into the base of the perianth, usually definite in number, opposite the segments of the perianth, to which they are equal in number, seldom three; sometimes, in a few polygamous genera, indefinite in number. *Ovary* one, three-celled, or deeply three-lobed; the lobes or cells one-seeded, with an erect ovule, rarely one-seeded. *Fruit* baccate or drupaceous, with fibrous flesh. *Albumen* cartilaginous, and either ruminant or furnished with a central or ventral cavity; *embryo* lodged in a particular cavity of the albumen, usually at a distance from the hilum, dorsal, and indicated by a little nipple, taper or pulley-shaped; *plumule* included, scarcely visible; the cotyledonous extremity becoming thickened in germination, and either filling up a pre-existing cavity, or one formed by the liquefaction of the albumen in the centre.—*Trunk* arborescent, simple, occasionally shrubby and branched, rough, with the dilated half-sheathing bases of the leaves or their scars. *Leaves* clustered, terminal, very large, pinnate, or flabelliform, plaited in vernation. *Spadix* terminal, often branched, enclosed in a one or many-valved spathe. *Flowers* small, with bractlets. *Fruit* occasionally very large. (R. Brown, 1810.)

PROPERTIES.—Palms, considered in a dietetical and medicinal point of view, are of the highest importance to the inhabitants of tropical regions. Their *stems* yield starch (sago) sugar, and wax; their *terminal leaf buds* are boiled and eaten as a kind of cabbage; their *fruits* yield oil, sugar, and resins; and their *seeds* form articles of food, and yield, by pressure, fixed oil.

In the abundance of *sugar* and *starch* which the palms yield, this family resembles the grasses. But they are distinguished from the latter in containing, in some cases, a large quantity of fixed oil. To these three principles are chiefly due the nutritive qualities of palms. But these substances being non-nitrogenized, are merely fat-making and heat-yielding, and without the addition of *proteine compounds* (found in the seeds, and probably in other edible parts of palms), would be insufficient to support life.

Palm sugar, in the crude state, is called *jaggary*. By fermentation, it yields *toddy* or *palm wine*, from which, by distillation, an ardent spirit (*arrack* or *rack*) is obtained. *Date sugar*, and also other kinds of palm sugar, are imported into England, and are used by grocers for mixing; but, being deficient in what in trade is called "strength," they do not pay for refining.²

Wax, *astringent matter* (tannin), and *resinous principles*, are useful products obtained from palms, but they are of less frequent occurrence than the substances before mentioned. Still less frequently met with are *acid* principles.

The ashes obtained by the combustion of palm leaves yield *potash*.

¹ Sir J. E. Smith, *Engl. Flora*, ii. 158.

² *Pharmaceutical Journal*, vol. v. p. 61, 1845.

1. PALMÆ FARINIFERÆ.—SAGO PALMS.

The farinaceous substance called *sago* is obtained from the stems of several palms. Those of the genera *Sagus* and *Saguerus* are the most important, and will be separately noticed.

The trunk of old trees of *Caryota urens*, called, by Robinson,¹ the *Sago palm of Assam*, yields a sago which both Roxburgh² and Robinson consider to be very little if at all inferior to the sago of the Malay countries. From *Phoenix farinifera*, which grows in the Coromandel coast, is likewise obtained a sago, but which is less nutritious and palatable than the common sago.³ *Corypha umbraculifera*, or the Talipat palm, yields sago in Ceylon; which would appear from the statement of Bennett⁴ to be of inferior quality.

Japan Sago is said to be obtained from several species of *Cycas*. None of this, however, reaches England. (See order CYCADEÆ.)

49. SAGUS, Gærtner.

Sex. Syst. Monœcia, Hexandria.

Metroxylon, Rottb.

Gen. Char.—*Flowers* hermaphrodite or polygamo-monœcious on the same spadix.

Spadix much branched, sheathed by many incomplete spathes. *Amenta* terete. *Bract* squamiform: *bractlets* very densely villose-bearded, connate like a cupule. *Calyx* 3-cleft. *Corolla* 3-partite. *Stamens* 6: filaments subulate, connate at the base; *anthers* affixed by the back. *Ovary* subtrilocular: *stigmata* 3, connate in a pyramid. Berry coated by reversed scales, 1-seeded. *Albumen* ruminated or uniform. *Embryo* dorsal. (*Blume*, Rumphia.)

1. SAGUS LÆVIS, Rumph. i. 76, tab. 86 and 126–127 (nomine S. Rumphii); Blume, Rumphia, vol. ii. p. 147; Jack, in Comp. Bot. Mag. i. 266; *Sagus inermis*, Roxb. Fl. Ind. iii. 623; *Metroxylon læve*, Mart. Gen. et Sp. Plant. p. 215, 2; Kunth, Enum. Plant. iii. 214, 2. *Metroxylon Sagus*, Rottb. *Rambia* or *Rambija* of the Malays. The *Unarmed Sago-Palm*.

Stem tallish. Petioles, rachides, and spathes, unarmed. Fruit somewhat globose, and depressed on both sides. (*Blume*, in Rumphia, p. 147.)

Islands of the Indian Archipelago, Sumatra and Borneo, and the islands between them, growing spontaneously in low swampy lands.

A large quantity of granular sago is prepared from this species⁵ in Sumatra especially, the peninsula of Malacca, and in Borneo. It is chiefly exported to Europe, Bengal, and China. The farina which is brought from Siak, on the northern coast of Sumatra, although inferior in whiteness to that of Borneo, is much sought after on account of its being less friable. It commonly fetches twice the price of the latter.⁶

The quantity of sago yielded by this palm is prodigious: Crawford⁷ says 500 or 600 lbs. is not an unusual produce for one tree: and Blume mentions 600 to 800 lbs. as the quantity obtained from a single tree when mature.

2. SAGUS GENUINA, Rumph. (ex parte); Blume, Rumphia, vol. ii. p. 150; *Sagus Rumphii*, Roxb. Fl. Ind. iii. p. 623 (excl. synonym.); *Sagus spinosus*, Roxb. ibid.; *Metroxylon Rumphii*, Mart. Gen. et Sp. Palm. p. 214, tab. 102 and 159.

Stem of middling height. Petioles, rachides, and spathes prickly; the prickles scattered or confluent. Fruit somewhat globose, depressed on both sides. (*Blume*.)

¹ A Descriptive Account of Assam, p. 56, Calcutta, 1841.

² Flora Indica, vol. iii. p. 626.

³ Ceylon, and its Capabilities, p. 95, Lond. 1843.

⁴ Roxburgh (Flora Indica, vol. iii. p. 623) says that from the pith of this tree "the granulated sago which we meet with in Europe is made."

⁵ Blume, Rumphia, vol. ii. p. 148.

⁶ Ibid., p. 786.

⁷ History of the Indian Archipelago, vol. i. p. 393.

Islands of the Indian Archipelago. Abounds in the Malacca islands, especially where the nutmeg and clove grow naturally.

"This, the Malay Sago Palm, is the tree the pith of which is the staff of life to the inhabitants of the Moluccas." (Roxburgh.)

The stature of this tree seldom exceeds thirty feet. Before maturity, and previous to the formation of the fruit, the stem consists of a thin hard wall, about two inches thick, and of an enormous volume of tissue (commonly termed the *medulla* or *pith*), from which the farina, called sago, is obtained. As the fruit forms, the farinaceous medulla disappears; and when the tree attains full maturity, the stem is no more than a hollow shell. The utmost age of the tree does not exceed thirty years.¹

50. SAGUERUS SACCHARIFER, Blume.—THE GOMUTO PALM.

Sex. Syst. Monœcia, Polyandria.

SYNONYMES.—*Palma Indica vinaria secunda*, *Saguerus*, sive *Gomutus Gomuto*, Rumph. Amb. i. p. 57, t. 13; *Anau*, Marsden, Hist. Sum. p. 88, 3d ed.; *Saguerus Rumphii*, Roxb. Fl. Ind. iii. 626; *Arenga saccharifera*, Mart. Gen. et Sp. Palm. p. 191, tab. 108.

BOTANY. Gen. Char.—*Flowers* monœcious by abortion, on separate spadices, sessile, the female ones between two males. *Spadices* simply branched. *Spathes* many incomplete. *Calyx* 3-cleft, with imbricated leaflets. *Corolla* 3-petalous, with valvate æstivation. MALES: *Stamina* indefinite: *filaments* filiform: *anthers* linear, cuspidate. FEMALES: *Ovary* trilocular, with the *Ovule* affixed at the bottom of the internal angle. *Stigmata* 3, acute, connivent. *Berry* 3- or, by abortion, 2-seeded. *Albumen* uniform. *Embryo* dorsal. (Blume.)

Sp. Char.—*Petioles* unarmed. *Segments* of the fronds linear-lanceolate, at the base 1- or sub-2-auriculate, beneath whitish. *Branches* of the spadices elongated, fastigate, pendulous. *Berry* turbinate-globose. (Blume.)—From 20 to 25 feet high: readily distinguished by its rude and wild aspect.

Hab.—Very common in the islands of the Indian Archipelago, the Moluccas, and the Philippines.

A saccharine juice called *nëra* or toddy is obtained in large quantities by wounding the spadices and receiving the liquor in earthenware pots or bamboos closely fastened beneath.² This juice yields by boiling a coarse dark kind of sugar (*jaggery*), and by fermentation an intoxicating beverage. Wine which is used by the Chinese residing in the Indian islands in the preparation of Batavian arrack.³ When the trees are exhausted by the incessant draining of their juices, sago of good quality is obtained from the trunk—as much as 150 to 200 lbs. weight from a single tree.⁴

The flesh of the fruit is acrid, and affords a juice which when applied to the skin occasions great pain and inflammation. The inhabitants of the Moluccas were in the practice of using in their wars, in the defence of posts, a liquor afforded by the maceration of the fruit, which the Dutch denominated *hell water* (*aqua infernalis*).⁵

SAGO.

(Sago; *Saguslævis*, Rumph., et aliæ fortasse *Palmarum* species. *Caudicis Fœcula*, L.)

HISTORY.—Sago does not appear to have been known to the Greeks, Romans, or Arabians. The preparation of sago-meal and sago-bread, as carried on at Fanfur

¹ Crawford, *History of the Indian Archipelago*, vol. i. p. 384.

² Marsden's *History of Sumatra*, p. 88, 3d edit. 1811.

³ Crawford's *History of the Indian Archipelago*, vol. i. p. 399, 1820.

⁴ Blume, *Rumphia*, vol. ii. p. 126.

⁵ Crawford I, op. cit.

(Kampar, in Sumatra?), was first described by Marco Polo¹ in the 13th century. Sago-bread was described and figured by Clusius.²

Granulated sago was not known until a later period. It is said³ to have been introduced into England in 1729, into France in 1740, and into Germany in 1744. Rumphius⁴ states that in Borneo grains of the size of a coriander seed are made from the farina of the *Saguerus* (*Saguerus saccharifer*, Blume).

The word *sagu* (also written by some of the earlier authors *zagu* and *saga*⁵) is the Malay name both for the palm and its farina:⁶ it is also used in Java to signify the bread made from the farina.⁷

COMMERCE.—Sago is brought to England from Singapore in bags, &c. The quantity on which duty was paid in 1840 was 26,895 cwt.

Newbold⁸ gives the following as the quantities imported into Singapore in 1836:—

	Bundles.
Sago from Sumatra	157750
“ West Side Peninsula	140
“ Borneo, 1308 piculs	140560
“ North Islands, 140 piculs	15251
Total imported	313701

The quantity exported from Singapore in the same year was 28,764 piculs.

MANUFACTURE. a. *Of Raw Sago-Meal*.—The manufacture of sago-meal varies somewhat in different localities. In the Moluccas, it is procured as follows: When the tree is sufficiently mature, it is cut down near the root, and the trunk subdivided into portions of six or seven feet long, each of which is split into two parts. From these the medullary matter is extracted, and with an instrument of bamboo or hard wood is reduced to powder, like sawdust. To separate the farina from the accompanying bran and filaments, it is mixed with water, and the mixture then strained by a sieve. The strained liquor deposits the farina, which, after two or more edulcorations, is fit for use. This is *raw sago-meal*.⁹

b. *Of Sago-Bread*.—In the Moluccas, sago-cakes are made by throwing the dry meal into heated earthenware moulds: a hard cake is formed in a few minutes, so that one heating of the mould serves to bake several series of cakes.¹⁰

c. *Of Granulated Sago*.—To prepare this the meal is mixed with water and made into a paste, which is then granulated. Forrest says that in New Guinea granulated sago is made by mixing the sago-meal with water and passing the paste through a sieve into a very shallow iron pot held over a fire, by which it is made to assume a globular form; so that, he adds, our grain sago is half baked and will keep long. This, according to Blume, is the process which is followed by the Chinese colony in Singapore; the meal being first repeatedly worked and dried. Blume adds that, during the heating process, the grains are constantly turned, and that, though quite white at the commencement, they become hard and somewhat pellucid during the process.

One kind of pearl sago of the shops has been obviously subjected to some heating process: this is the *Tapioka sago* of Guibourt; but the application of heat must have been most carefully regulated, for charred sago is unknown to commerce. Some of the granulated sago of the

¹ *Travels in the Eastern part of the World in the Thirteenth Century*, translated from the Italian, with Notes, by W. Marsden, p. 614, 4to. Lond. 1818.

² *Erotic*, lib. i. cap. iii. p. 5, 1605.

³ Steek, quoted by J. A. Murray, *App. Medicam.* vol. iv. p. 17, 1790.

⁴ *Herbarium Amboin.* pars Ima, p. 61, Amst. 1750. “. in Borneo ex eadem conficiunt farina retunda grana Coriandri semen magnitudine et forma referentia.” I have given the words of Rumphius, because some highly respectable authorities (J. A. Murray and Guibourt) have overlooked this passage, and assumed that Rumphius does not mention granulated sago.

⁵ See the authorities quoted in C. Bauhin's *Pinax*.

⁶ Crawford, *History of the Indian Archipelago*, vol. i. p. 387, 1820.

⁷ Sir F. Drake, in Hakluyt's *Principal Navigations, Voyages, &c.* vol. iii. p. 742.

⁸ *Political and Statistical Account of the British Settlements in the Straits of Malacca*, vol. i. p. 304, Lond. 1839.

⁹ Crawford, *op. supra cit.* vol. i. p. 390. Mr. Crisp (*Asiat. Researches*, vol. vi. 1799) has described the mode of preparing sago-meal in the Pogy Islands, lying off Sumatra. See, also, Forrest's *Voyage to New Guinea*, 2d edit. 1780, pp. 39-41, for the method of preparing it by the Papuans.

¹⁰ Forrest (*op. supra cit.*) has figured a mould, which he calls the *Papua oven*.

shops presents no evidence of having been heated; and it has, therefore, been supposed that its granulation must have been effected by a mill.

DESCRIPTION OF SAGO.—Sago occurs in commerce in two states—pulverulent and granulated.

1. Pulverulent Sago; Sago Meal; Sago Flour (*Farina Sagi*).—This is imported in the form of a fine amylaceous powder. It is whitish, with a buffy or reddish tint. Its odour is faint, but somewhat unpleasant and musty. Viewed by a powerful pocket-lens, it presents a glistening granular appearance. Examined by the microscope, it is found to consist of irregularly elliptical or oval, more or less ovate, usually isolated particles,¹ which are often somewhat narrowed or tapered at one extremity. Owing to their mutual pressure, many of them appear as if truncated, either by a single plane perpendicular to the axis of the particle, in which they are more or less mullar-shaped—or by two inclined planes, giving the particles a dihedral extremity. Some of them resemble in form a caoutchouc bottle cut off at the neck. From their strong lateral shading they are obviously convex. Many of the particles are more or less broken. Most of them have an irregular or tuberculated surface, as if eroded. The hilum, when perfect, is circular; but it cracks in the form of a single slit, or of a cross, or in a stellate manner. The surface of the particles presents the appearance of a series of concentric rings or annular lines, which, however, are much less distinct than in potato starch. These lines are indicative of the concentric layers of which each particle is composed. When examined by the polarizing microscope, the particles show a black cross, the centre of which is the hilum.

I have met with sago-meal in commerce under different names. Once, I received a sample from Cockermouth, in Cumberland, where it was sold as "*Food for the People*." A sample of a fine white and carefully-prepared sago-meal was given me under the name of *arrow-root*. I shall distinguish it as *refined sago-meal*.

The following information respecting the mode of refining sago-meal was furnished me by a starch manufacturer: "By sifting and washing, the best sago-meal loses about one-fifth of its weight in the form of earthy matter and woody fibre. The meal thus sifted and washed is then bleached by means of chloride of lime and sulphuric acid. The bleached meal is afterwards washed in successive waters until a perfectly pure product is obtained. In this state it serves as a food for infants and invalids. Coloured by turmeric, and flavoured by the essential oils of cassia and bitter almonds, it forms a *custard powder*. Without the colouring matter, it serves as a *blanc-mange powder*."

2. Granulated Sago; Grain Sago (*Sagus granulosa*); Grana Sagi.—The grains are more or less rounded masses of variable size and colour. Examined by a microscope with a low object-glass (say of 2- or 3-inch focus), they are seen to be masses of glistening particles. There are two kinds of granulated sago—brown sago, and pearl sago.

*a. Common or Brown Sago (*Sagus fusca*); Sagou gris des Moluques, Planche and Guibourt.*—This is the only kind of sago which was known in English commerce prior to the introduction of pearl sago.

¹ The following measurements, in parts of an English inch, of the particles of starch of sago-meal, brown sago, and pearl sago, were made for me by Mr. George Jackson:—

PARTICLES.	SAGO-MEAL.		BROWN SAGO.		PEARL SAGO.	
	Long diam.	Short diam.	Long diam.	Short diam.	Long diam.	Short diam.
1.	0.0022	0.0016	0.0026	0.00155	0.0031	0.0019
2.	0.00195	0.00135	0.0020	0.0014	0.0022	0.0015
3.	0.0017	0.0013	0.0017	0.0015	0.0021	0.0014
4.	0.0014	0.0014	0.0017	0.0012	0.0018	0.0013
5.	0.0013	0.00095	0.0013	0.0010	0.0015	0.0012
6.	0.0012	0.00095	0.0009	0.0006	0.0017	0.0012
7.	0.0005	0.0008	0.0008	0.0008	0.0012	0.0005
8. ....	.....	.....	0.00075	0.0006	0.0008	0.00075

It occurs in somewhat irregularly-rounded or globular masses or grains, which are whitish on one side, and grayish-brown on the other. The ordinary brown sago of the shops consists of grains which are usually about the size of the grains of pearl barley. This may be termed the *smaller* or *ordinary brown sago*. It is the *sagou gris des Moluques* of both Planche and Guibourt. But there is another variety, the globular masses of which are larger, sometimes as large as gray peas. To distinguish it from the smaller sort just mentioned, I shall call it *large brown sago*. I received it first from Dr. Douglas MacLagan, of Edinburgh, and subsequently from Professor Guibourt, who terms it *gros sagou gris des Moluques*. The smaller masses of it are about equal in size to the larger masses of the former sort of brown sago. Except in the size of the grains or masses, the two sorts are identical.

Examined by the microscope, the grains of brown sago are found to consist of particles like those of sago-meal, but somewhat more broken and less regular in their shape. Some of them present the appearance of containing in their interior a smaller particle, or rather, perhaps, an air-cavity, which, when examined by polarized light, forms the centre of the black cross. Intermixed with the starch particles is a yellowish-brown substance, which gives colour to the sago.

β. *Pearl Sago (Sagrus perlatus)*.—The manufacture of this kind of sago is comparatively recent. Crawford,¹ who wrote in 1820, says: "Within the last few years the Chinese of Malacca have invented a process by which they refine sago so as to give it a fine pearly lustre. . . . A small quantity of it, exposed for sale in the London market in 1818, sold for about thrice the price of ordinary [that is, brown] sago." The sago used by the Chinese at Malacca in the manufacture of pearl sago is, according to Newbold,² brought from Sumatra. Pearl sago is also prepared at Singapore.³

Pearl sago occurs in pearl-like grains, which vary in size from that of poppy seeds to that of white mustard seeds, or even somewhat larger than these. The shape of the larger grains is more or less globular, that of the smaller ones being often much less regular. The surface of the larger grains is smooth, even, and regular; that of the small grains often rough, uneven, and somewhat tuberculated. Occasionally, two or three of the smaller grains adhere together. Some samples are white, some brownish yellow, pink, or roseate. The coloured grains are not of uniform tint over the whole of their surface; often being on one side white, on the other coloured. By the aid of a solution of chloride of lime, the coloured kinds can be bleached and rendered perfectly white (*bleached pearl sago*).

When submitted to microscopic examination, pearl sago is found to consist of the same kind of starch particles as sago-meal, but all more or less ruptured, and presenting indistinct traces of rings. These peculiarities are doubtless produced by the process of granulation.

αα. *White Pearl Sago*.—Grains smaller than white mustard seeds; opaque and white on one side, pearly on the other. The filtered cold aqueous infusion does not strike a blue colour with tincture of iodine. The whiteness of this kind of pearl sago has probably been produced by bleaching.

ββ. *Coloured pearl sago*.—Grains of different size. Those of some sorts are not larger than poppy seeds (*small coloured pearl sago*), while those of other sorts are nearly as large, or even somewhat larger, than white mustard seeds (*large coloured pearl sago*). The colour varies in intensity, and slightly in shade also; but the prevailing tint is that of bran, or sometimes pinkish brownish yellow. Some sorts are as pale as ground, unsifted wheat-flour (*pale-coloured pearl sago*); others are nearly as deep-coloured as bran itself. Some of the larger sorts have a grayish or brownish colour (*grayish* or *brownish pearl sago*); but, like all kinds of coloured

¹ *History of the Indian Archipelago*, vol. iii. p. 349, 1820.

² *Political and Statistical Account of the British Settlements in the Straits of Malacca*, vol. i. pp. 243-4, 1830.

³ Blume, *Rumphia*, vol. ii. p. 148.

sago, the tint is not uniform on different parts of the same grain, being deep on one side and pale on the other.

The filtered cold aqueous infusion of some sorts does not strike a blue colour with tincture of iodine. This kind corresponds to the *Sagou rosé des Moluques* of Planche and Guibourt.

The filtered cold aqueous infusion of other sorts yields a blue colour on the addition of tincture of iodine, showing that a higher temperature has been employed in the preparation of it than of other sorts. This corresponds to the *Sagou-tapioka* or *Tapioca-sago* of Guibourt. When examined by the microscope, the particles are found to be more ruptured and torn—an obvious effect of heat on them. This sort of pearl sago is often not distinguishable by its external appearance from that of the *Sagou rosé des Moluques* of Planche and Guibourt.

Under the name of *damaged pearl sago*, I have received a sample of coloured pearl sago, some of the particles of which are yellow (from sulphur-yellow to orange coloured). When bleached by means of chloride of lime, it becomes quite white (*bleached pearl sago*).

FACTITIOUS SAGO.—This is prepared in both Germany and in France (at Gentilly, near Paris) with potato-starch. It occurs both white and coloured.

I have two kinds of *white factitious sago*—one small-grained, the grains of which are scarcely so large as white mustard seeds; the other large-grained, the grains of which are intermediate in size between white mustard seeds and coriander seeds. The first, I met with in English commerce; for the other, I am indebted to Professor Guibourt.

I have also two kinds of *coloured factitious sago*, both large-grained—one red,¹ the other brownish,² and somewhat resembling brownish pearl sago. For both of these I am indebted to Professor Guibourt.

The white and the red sorts are remarkable for being spherical and smooth.

The microscope can alone distinguish factitious sago from the real sort. The difference in the size, the shape, and other characters, between the particles of sago-starch and the unaltered particles of potato-starch, readily distinguish the one from the other. (See also *Potato-starch*.)

But many of the starch particles of potato sago are ruptured by the influences to which they have been subjected during the preparation of the sago. They have become swollen, ruptured in the direction of their long axis, and, by drying, have shrivelled, leaving a long, linear, sometimes curved or even-branched line with invaginated or involuted edges, indicating the situation of the rupture.

I have received from Professor Guibourt samples of "*Sagou des Maldives* de Planche, donné par lui," and "*Sagou de la Nouvelle Guinée* de Planche,³ donné par lui," and find them to be fictitious sagos made from potato starch. The grains of New Guinea sago are undistinguishable externally, and, by the microscopic examination of their starch particles, form red-coloured "*Sagou de fécule de pomme de terre*," also sent me by Professor Guibourt. Both are bright red on one side and whitish on the other. Most of their starch grains are ruptured and shrivelled as above described. The Maldivé Sago is paler coloured, and some of its starch particles are little or not at all altered; others are ruptured and shrivelled.

COMPOSITION.—Sago has not been analyzed. The pure starch, of which it essentially consists, doubtless has the same composition as other amylaceous substances, viz., $C^{12}H^{10}O^{10}$. Sago-meal is contaminated with various impurities (see *ante*, p. 164). Granulated sago contains some colouring matter, particles of which may readily be detected by the microscope.

CHEMICAL CHARACTERISTICS.—Sago possesses the general characters of an amylaceous substance.

Sago-meal is insoluble in cold water; but, by boiling in water, it almost entirely

¹ This is, perhaps, the kind mentioned by Planche (*Journ. de Pharm.* t. xxiii. p. 305, 1837) as being "falsified sago coloured by cochineal."

² This, perhaps, is the brown sort of German sago made from potato-starch, and said, by Dierbach (*Synopsis Materia Medica*, Abt. i. S. 27, 1811), to be coloured by burnt sugar.

³ *Journ. d. Pharm.* tom. xxiii. p. 155, 1837.

dissolves, and yields a tolerably clear solution. The decoction, when cold, strikes a blue colour with tincture of iodine.

Granulated sago swells up in cold water, but does not completely dissolve by boiling, a more or less considerable amount of insoluble matter remaining behind. The remarkable difference in the action of boiling water on sago-meal, and on different kinds of granulated sago, leads me to suspect that some substance of difficult solubility in water is used in the preparation of the paste for making granulated sago. The filtered cold aqueous infusion of some sorts of pearl sago (*Sagou-tapioka* of Guibourt) strikes a blue colour with tincture of iodine. The cold infusion of brown sago is rendered milky by nitrate of silver, diacetate of lead, and protonitrate of mercury; but the cold infusions of pulverulent and of pearl sago are scarcely affected by these tests.

PHYSIOLOGICAL EFFECTS.—It is nutritive and easy of digestion, and is an important article of food in some parts of the East. "The Malay sago palm," says Dr. Roxburgh, "is the tree, the pith of which is the staff of life to the inhabitants of the Moluccas." It is probable that this pith contains some nitrogenized nutritive substance in addition to the amylaceous matter.

USES.—Sago puddings are occasionally brought to table. But the principal use of sago is to yield a light, nutritious, easily-digestible, and non-irritating article of food for the invalid in febrile and inflammatory cases. For this purpose it should be boiled in water (in some cases milk is preferred), the solution strained, and flavoured with sugar and spices, or even with a little white wine, when the use of this is not contraindicated.

2. PALMÆ OLEIFERÆ.—OIL PALMS.

Oil is obtained from the fruit of some, and from the seeds of many palms. Two oils obtained from palms are found in commerce: they are palm oil and cocoa-nut oil; the one obtained from a species of *Elæis*, the other from a *Cocos*.

51. *Elæis*, Jacquin.—The Guinea Oil Palms.

Sex. Syst. Diœcia, Hexandria.

(*Fructûs oleum*.)

Palm oil is obtained from two species of *Elæis*, both natives of Guinea, and to both of which the name of Guinea Oil Palm is equally applicable. The oil resides in the fleshy portion of the fruit, which, in this respect, resembles the olive.

1. *ELÆIS GUINEENSIS*, Jacquin; *The True Guinea Oil Palm*; *The Palm Oil-Tree*; Sloane's Jamaica, vol. ii. p. 113, 1725; *Avoira*, Aubl., Pl. de la Guiane, 1775.—A native of Guinea; cultivated in tropical America. The drupes are about the size of pigeons' eggs, ovate, somewhat angular, deep orange yellow, collected in heads. They have a thin epicarp, a fibrous, oily, yellow sarcocarp, which covers and closely adheres to the hard stony putamen or endocarp, within which is the seed.

From the sarcocarp is procured *palm oil* (*oleum palmæ*). This is obtained by boiling the pulp in water, by which the oil separates and floats on the surface.

2. *ELÆIS MELANOCOCCA*, Gartner.—The drupes are somewhat smaller than those of the preceding species. Some time since I received from Mr. Warrington a bunch of them, which had been recently brought from Guinea as the fruit from which palm oil is obtained. The flesh of the fruit is oily, and has the well-known odour and colour of palm oil. Gartner¹ thought that it might be only a variety of *E. guineensis*; but Von Martius,² who has fully described it, regards it as a distinct species.

At the ordinary temperatures of this country, it is solid, and might, therefore, with more propriety be termed *palm butter*. It is said that, when quite fresh, it fuses at 81° F.; but that, by keeping, its fusing point rises. Stenhouse³ found that very old palm oil required a temperature of 98½° F. to fuse it.

Palm oil has a rich orange yellow colour, a sweetish taste, and an agreeable odour resembling

¹ *De Fructibus et Semin. Plant.* vol. i. p. 18, 1801.

² *Ann. d. Chemie u. Pharm.* Bd. xxxvi. S. 50.

³ *Palma Brasil.* p. 62, tab. 54-56.

that of the rhizome of the Florentine orris. It is soluble in boiling alcohol and in ether. By exposure to solar light it becomes white.

Palm oil requires to be bleached for various uses in the arts, and there are several agents which are used for decolorizing it—viz., chlorine, oxygen, powerful acids (sulphuric, nitric, or chromic acid), and the combined influence of air, heat, and light.¹

Palm oil consists of *oleine*, *palmitine*, and *colouring matter*. As found in commerce, it usually contains also *free fatty acids* (oleic and palmitic) and *free glycerine*, and, therefore, may be said to be rancid. The cause of the separation of these acids from the glycerine has not been satisfactorily explained. The quantity of them increases with the age of the oil, and, according to Pelouze and Boudet,² varies from 33 to 80 per cent of the entire oil. In proportion as the quantity increases, the fusing point of the oil rises. The glycerine which is set free gradually becomes converted into *sebacic acid*, which is also found in old palm oil. These various changes seem to be effected by a kind of fermentation, to the commencement of which, according to Guibourt,³ the presence of atmospheric air is necessary.

Palmitine is a white solid fat, which is resolved, by saponification and by the fermentation just alluded to, into *palmitic acid* ($C^{32}H^{50}O^3+HO$), considered by Dumas to be identical with ethalic acid—and *glycerine* (oxide of glycerule).

The Africans use palm oil as a kind of butter. It is now rarely employed in medicine. By the public it is occasionally used by way of friction in bruises, sprains, &c. It is a constituent of the common black bougie. Its ordinary use in this country is in the manufacture of soap and candles. It readily becomes rancid.

The *seeds* of both species of *Elais* are nutritive. They yield by pressure a fixed oil (*palm-seed oil*; *oleum palmæ seminis*), which is solid at ordinary temperature. It is devoid of the orange-yellow colour and orris odour of palm oil. It is said to be used in Africa as a kind of butter. It is rarely brought to Europe, but a few years since I obtained from Africa a specimen of it, with a sample of the seeds from which it was procured.

52. *Cocos nucifera*, Linn.—The Cocoa-Nut Tree.

Sex. Syst. Monœcia, Hexandria.
(Semina.)

Tenga, Rheede, Hort. Malab. i. t. 1, 2, 3, 4; *Calappa*, Rumph., Herb. Amb. i. t. 1, 2.—A native of tropical countries, but does not thrive except near the coast. It is one of the most important and valuable palms. Five varieties of it are indigenous to Ceylon.⁴ Its stem yields *porcupine wood*. A powerful oil is extracted from the bark, which is used by the Cingalese in the form of ointment in cutaneous diseases. By incision into the spathe at the top of the leaves, *sweet toddy* is obtained, which, by fermentation, yields *palm wine*, from which *arrack* is procured by distillation. The fruit, the *cocoa-nut in the shell* of the shops, is a drupe, the fibrous portion of which yields *coir*, which is used for making ropes, mats, &c.; and is also employed, as a substitute for horse-hair, for stuffing mattresses. Within the *cocoa-nut* is the nucleus or kernel (in the dried state called *copra* in commerce), consisting of the albumen (the edible portion), within which is the unsolidified liquor amnii (called *cocoa-nut milk*) and the embryo, which is lodged in a small cavity at the base of the albumen. The albumen and *cocoa-nut milk* have been analyzed by Brandes,⁵ Buchner,⁶ and Bizio.⁷ According to the latter authority, 100 parts of *cocoa-nut milk* contain—water, 95; crystallizable glycine (identical with *orcine* and *granatine*), 3.825; *zymome*, 0.75; and *mucilage*, 0.25 [loss, 0.175]. In 100 parts of the albumen, he found—71.488 of oil; 7.665 of *zymome*; 3.588 of *mucilage*; 1.595 of crystallizable glycine; 0.325 of yellow colouring matter; and 14.950 of woody fibre [loss, 0.392]. There are two modes, practised at Malabar and Ceylon, of obtaining *cocoa-nut oil* or *oleum cocoa-nut butter*: the one is by pressure, the other by boiling the bruised nut and skimming off the oil as it forms on the surface. It is a white solid, having a peculiar odour, like that of the flowers of *furze* (*Ulex europæus*), and a mild taste. It fuses at a little above 70° F., readily becomes rancid, and dissolves easily in alcohol. It consists of a solid fat called *corin* or *corinine* (a combination of glycerine and *cocinic* or *coco-stearic acid*, $C^{27}H^{26}O^3+2HO$), and of a liquid fat or *oleine*, which has not been much examined. *Cocoa-nut oil* is used in the manufacture of candles and soap.⁸ It serves particularly for the manufacture of marine soap, which forms a lather with sea-water. *Cocoa-nut oil* has been used for medicinal purposes. Loureiro considered it, when fresh, not inferior to olive oil. On the continent of India, as well as in Ceylon, it is used as a pomatum for promoting preserving, and softening the hair. Mr. Bennett thinks that if it were perfumed, and used for this purpose by Europeans, it would soon display its virtues to such advantage as

¹ Knapp's *Chemical Technology*, vol. i. p. 431, 1848.

² *Journ. de Pharm.* t. xxiv. p. 355, 1835.

³ *Hist. Nat. des Drogues simples*, 4me édit. t. ii. p. 142, 1849.

⁴ *The Coco-Nut Palm, its Uses and Cultivation*, by J. W. Bennett, 2d edit. Lond. 1836.

⁵ Quoted by L. Gmelin, *Handb. d. Chemie*, Bd. ii. S. 1338.

⁶ *Repert. für die Pharm.* Bd. xxvi. S. 337, 1827.

⁷ *Journ. de Pharm.* t. xix. p. 455, 1833.

⁸ Knapp's *Chemical Technology*, vol. i. p. 468, 1848.

to ensure its general use. But the great drawback to its medicinal employment in pomatums and unguents is its odour, and the facility with which it becomes rancid.

3. PALMÆ CERIFERÆ.—WAX-BEARING PALMS.

The only palm wax which has been brought to Europe as an article of commerce is the produce of the following palm:—

CORYPHA CERIFERA, Mart., Gen. et Sp. Palm. tab. 49 and 50; *Caranaiba*, and *Ananachi cariri*, Piso et Marcgrave, pp. 62 and 130, 1648; *Carnauba*, Brande, Phil. Trans. 1811, and Virey, Journ. de Pharm. t. xx. p. 112, 1834.—Grows on the shores of the Rio Francesco, in the Brazils.¹ In the axillæ of the leaves, waxy scales are secreted, which are collected and melted by the Indians. The wax thus obtained is imported into this country from Rio Janeiro under the names of *Carnauba Wax*, *Brazilian Wax*, or *Palm Wax*. It was submitted to chemical examination by Mr. Brande, and has subsequently been analyzed by Lewy, who found it to consist of $C^{36}H^{36}O_2$. The fusing point of this wax is 180° F. It is, therefore, less fusible than bees' wax, whose melting point is about 150° F. Being a genuine wax, it is applicable to some of the purposes for which common bees' wax is now employed.

4. PALMÆ RESINIFERÆ.—RESIN-BEARING PALMS.

The only resinous substance used in medicine and the arts, and which is obtained from the palms, is *Dragon's blood*, the produce of *Calamus Draco*.

53. *Calamus Draco*, Willd.—The Dragon's Blood Calamus.

Sez. Syst. Diœcia, Hexandria.

(Resina; Sanguis Draconis.)

Palma Juncus Draco, Rumph., Herb. Amb. pars v. p. 114, t. lviii. Fig. 1.—A native of the islands of the Indian Archipelago. The berry, which is round, pointed, and about the size of a cherry, yields a resinous substance called in commerce *dragon's blood* (*sanguis draconis*)—a term which is also applied to a product of the *Dracæna Draco* (vide LILIACEÆ), and likewise to a substance obtained from the *Pterocarpus Draco* (vide LEGUMINOSÆ). Lieut. Wellstead says that, in Socotra, Dragon's blood exudes spontaneously from the stem of a tree.² The following are the kinds of it which I have met with:—

1. *Dragon's blood in the reed; Dragon's blood in sticks; Sanguis Draconis in baculis*.—This occurs in dark reddish-brown sticks of from twelve to eighteen inches long, and from a quarter to half an inch in diameter, enveloped with the leaf of the Talipot palm (*Corypha umbraculifera*), and bound round with slender slips of cane (probably the stem of *Calamus petraeus*). It is supposed to be obtained from a species of *Calamus*, perhaps *C. Draco*.

2. *Dragon's blood in oval masses; Dragon's blood in drops; Sanguis Draconis in lachrymis*, Martius.—This occurs in reddish-brown lumps of the size and shape of an olive, enveloped with the leaf of *Corypha umbraculifera* or *Corypha Licuala*, which thus connects them together in a row, like the beads of a necklace. This kind is rare in English commerce. It is obtained, according to Rumphius, by rubbing or shaking the fruit of *Calamus Draco* in a bag. A resinous exudation is by this means separated, and is afterwards softened by heat, and made up in these masses.

3. *Dragon's blood in powder*.—This is a reddish powder, of very fine quality, imported from the East Indies. It is probably the dust obtained from the fruit of the *C. Draco*, in the way just described.

4. *Dragon's blood in the tear; Sanguis Draconis in granis*, Martius.—It occurs in irregular pieces, some as large as the fist. T. W. C. Martius³ says pieces of the fruit of the *Calamus Rotang* are frequently found intermixed.

5. *Lump Dragon's blood; Sanguis Draconis in massis*.—This is of inferior quality. It occurs in large masses, which, when broken, present a heterogeneous appearance.

Other varieties of Dragon's blood are described, but I have never met with them. Guibourt mentions a *dragon's blood in cakes*, and a *false dragon's blood in oval masses*.

Dragon's blood is composed of red resin (called *draconin*) 90.7, fixed oil 2.0, benzoic acid 3.0, oxalate of lime 1.6, phosphate of lime 3.7.⁴ According to Johnstone,⁵ the resin of lump dragon's blood has the formula $C^{40}H^{21}O_8$; that of reed dragon's blood $C^{40}H^{20}O_9$.

¹ The stems of this palm are sold at Haynes's timber-yard, Long Lane, Smithfield, London, under the name of *Palm Wood*.

² *Athenæum*, May 16, 1835; also, *Journal of Royal Geographical Society*.

³ *Pharmakognosie*.

⁴ Herberger, *Journ. de Pharm.* xvii. 225.

⁵ *Phil. Trans.* for 1840, p. 384.

It is inert, or nearly so, but was formerly reputed an astringent. It is a constituent of some tooth-powders and tinctures, but is never prescribed by medical practitioners. Its principal consumption is for colouring spirit and turpentine varnishes.

5. PALMÆ TANNINIFERÆ.—TANNIN-BEARING PALMS.

The only palm which yields any officinal astringent substance is the *Areca Catechu*.

54. ARECA CATECHU, Linn.—CATECHU PALM.

Sex. Syst. Monœcia, Hexandria.

(Semen.—Extract of the kernels, *E.*—Carbo seminis, *Offic.*)

HISTORY.—*Areca* nuts are not mentioned in the writings of the ancient Greeks and Romans. Avicenna speaks of them under the name of *Fufel*.¹

BOTANY. **Gen. Char.**—1. MALE: *Calyx* three-parted. *Corolla* three-petalled. 2. FEMALE: *Calyx* three-leaved. *Corolla* three-petalled; *nectary* six-toothed. *Ovarium* superior, one-celled, one-seeded; attachment inferior. *Drupe* coriaceous. *Seed* single, ruminant. *Embryo* in the base of the albumen. (*Roxburgh*.)

Sp. Char.—*Trunk* straight and slender, from forty to fifty feet high. *Fronds* pinnate; *leaflets* compound, linear, opposite, premorse. *Spathæ* erect, ramous. *Male flowers* hexandrous. *Seed* of a roundish conic form, and obtuse. (*Roxburgh*.)

Hab.—Cultivated in all the warmer parts of Asia.

1. DESCRIPTION AND USES OF THE SEEDS.—The fruit of the *Catechu* palm is about the size and shape of a small egg, yellowish, and smooth. Within the fibrous pericarp is the seed (*areca nut*; *betel nut*; *pinang*). This is about the size of a nutmeg, roundish conical, flattened at the base, hard, horny, inodorous, externally reddish brown, internally brown with whitish veins. The principal part of the seed is the ruminant albumen, at the base of which is the embryo.²

The varieties of this fruit are numerous: of these, some have been figured by Blume,³ viz., *Pinang Putie* (*Areca alba*), *Pinang Susu* (*Areca lactea*), *Pinang Betul* (*Areca propria*), and *Pinang Pict*.

According to Morin,⁴ *areca* nuts (seeds) are composed of *tannin* (principally), *gallic acid*, *glutin*, *red insoluble matter*, *fixed oil*, *gum*, *oxalate of lime*, *lignin*, &c.

With lime and the leaves of *Piper Betel*, these nuts form the celebrated masticatory of the East, called *betel*. They are usually cut into four equal parts; one of which is rolled up with a little lime in the leaf of the *Piper Betel*, and the whole chewed. The mixture acts as a sialagogue, and tinges the saliva red. The Indians have an idea that by this means the teeth are fastened, the gums cleansed, and the mouth cooled. Peron⁵ was convinced that he preserved his health, during a long and difficult voyage, by the habitual use of the *betel*, while his companions, who did not use it, died mostly of dysentery. In this country, *areca-nut charcoal* is used as a tooth powder. I know of no particular value it can have over ordinary charcoal, except, perhaps, that derived from its greater hardness.

2. ARECA-NUT CATECHU.—In the southern parts of India, and probably in Ceylon, an extract called catechu is procured from *areca* nuts.⁶ The mode of preparing it has been described by Herbert de Jäger⁷ and Dr. Heyne.⁸ The last-

¹ Lib. ii. tract. ii. cap. 262, p. 306, Venet. 1564.

² *Roxburgh's Plants of Coromandel*, pl. 75; *Flora Indica*, vol. iii. p. 615.

³ *Rumphia*, vol. ii. p. 68, tab. 102, 1536.

⁴ *Voyage aux Terres Australes*.

⁴ *Journ. de Pharm.* viii. 449.

⁶ Ainslie (*Nat. Indica*, vol. i. p. 65) notices two preparations of *areca* nuts, which, he says, have been confounded with the true or real catechu (*i. e.* catechu of the *Acacia Catechu*). One of these he calls *cuttacambo* (in Tamool), the other *cashcuttie* (in Tamool); and he adds that both are brought to India from Pegu. It is probable, however, from his description, that by *cuttacambo* he means *gambur* (an extract of *Nuclea Gambir*), and by *cashcuttie*, *Pegu cutch* (an extract of *Acacia Catechu*).—Blume (*Rumphia*, vol. ii. p. 67) denies that an extract called catechu is procured from *areca* nuts; and says that the error has arisen from the circumstance that old and dry *areca* nuts, broken in small pieces, are macerated in rose-water in which catechu has been dissolved.

⁷ *Miscellanea curiosa*, Dec. ii. Ann. iii. p. 10, Norimb. 1663.

⁸ Dr. Heyne, *Tracts, Historical and Statistical, on India*.

mentioned author states that it is largely procured in Mysore, about Sirah, in the following manner: "Areca nuts are taken as they come from the tree, and boiled for some hours in an iron vessel. They are then taken out, and the remaining water is inspissated by continued boiling. This process furnishes *Kassu*, or most astringent terra japonica, which is black, and mixed with paddy husks and other impurities. After the nuts are dried, they are put into a fresh quantity of water, boiled again, and this water being inspissated, like the former, yields the best or dearest kind of catechu, called *Coury*. It is yellowish brown, has an earthy fracture, and is free from the admixture of foreign bodies."

None of the extracts brought from India under the denomination of catechu are distinguished by any name by which they can be referred to the areca nut. It is probable, however, that some of them which come over in the form of *round and flat cakes*, and also *in balls*, and which are more or less covered with paddy husks (glumes of rice), are obtained from this seed. A decoction of some of these kinds of catechu yields, when cold, a blue colour on the addition of iodine, indicating the presence of starch. The presence of fatty matter in them is considered by Professor Guibourt¹ to be a proof that the areca nut has been employed in their production.

I think it probable that the *Colombo* or *Ceylon catechu* of commerce, in the form of round flat cakes, covered by paddy husks, is the *Kassu* of Heyne; and Professor Guibourt is of opinion that the *dull reddish catechu in balls* partially covered by paddy husks is the *Coury* of Heyne. (For further details, the reader is referred to the article *Acacia Catechu*, where a general notice will be given of all the commercial sorts of catechu.)

†† Flowers with a true perianth free from the ovary (*superior ovary*), usually hermaphrodite.

ORDER X. MELANTHACEÆ, R. Brown.

CHARACTERS.—*Perianth* inferior, petaloid, in six pieces, or, in consequence of the cohesion of the claws, tubular; the pieces generally involute in aestivation. *Stamens* six; *anthers* mostly turned outwards. *Ovary* three-celled; many seeded; *style* trifid or three-parted; *stigma* undivided. *Capsule* generally divisible into three pieces; sometimes with a loculicidal dehiscence. *Seeds* with a membranous testa; *albumen* dense, fleshy. (R. Brown.)

PROPERTIES.—Several violently poisonous alkaloids (*veratria*, *colchicina*, *sabadillina*, and *jervina*) are peculiar to this order. They exist in combination with organic acids. These bases, as well perhaps as resins, are the active principles of the order. The Melanthaceæ are acids (emetics, purgatives, diuretics, and emhines) and sedatives (see vol. i. p. 258). When acting as poisons, they are called narcotico-acids (see vol. i. p. 234).

55. COLCHICUM AUTUMNALE, Linn.—COMMON MEADOW SAFFRON.

Sex. Syst. Hexandria, Trigynia.

(Herbæ agrestis cornus recens et exsiccatus: semen, L.—Cornus et semina, E.—The cormus and seeds, D.)

HISTORY.—Dioscorides² speaks of *Colchicum* (κολχικόν), and states that it grows abundantly in Messenia and at Colchis (from which latter place it received its name). Dr. Sibthorp³ found three species of *Colchicum* in Greece—viz. *C. autumnale*, *C. montanum*, and *C. variegatum*; and of these he considers the first to be the *Colchicum* of Dioscorides. In this opinion he is to a certain extent confirmed by the editors of the *Pharmacopœia Græca* (1837), who apply the modern Greek name of κολχικόν to *C. autumnale*. But there is reason to doubt the accuracy of this opinion: for this species is only found in Greece, on this side of the Sperchius, at an elevation of at least 3500 to 4000 feet—at Parnassus, and Thymphrastus; whereas

¹ *Journ. de Pharm. et de Chimie*, 5me Sér. t. xi. p. 303, 1847.

² *Prodr. Fl. Græcæ*, i. 250.

³ *Lib. iv. cap. 61.*

C. variegatum, which Fraas¹ thinks is the *αλχιών* of Dioscorides, is common, and occurs on the Xirobuni,² at an elevation of only 1000 to 2000 feet, at Hymettus, Messapius, and Helicon.

For the introduction of colchicum into modern practice we are chiefly indebted to Störk,³ in 1763; but partly, also, to the opinion that it is the active principle of a celebrated French remedy (*eau médicinale*) for gout.

BOTANY. **Gen. Char.**—*Perianth* single, tubular, very long, rising from a spathe; limb campanulate, six-partite, petaloid. [*Stamens* six, inserted into the throat of the tube. *Ovary* three-celled. *Styles* three, filiform, long. *Stigmas* somewhat clavate.] *Capsule* three-celled; cells united at the base (*Hooker*, with some additions).

Sp. Char.—*Leaves* plane, broadly lanceolate, erect (*Hooker*).

Root fibrous. *Cormus* (improperly called *root* or *bulb*) ovate, fleshy, large, covered with a loose brown membrane. The *leaves* are produced in the spring along with the fruit, and disappear before the flower appears. *Flowers* several, lilac or pale purple, arising from the cormus by a long, narrow white tube.⁴ *Fruit* oblong, elliptical, composed of three cells, which may be regarded as distinct follicles, with

Fig. 218.



Colchicum autumnale.

1. Closed capsule. 2. Open capsule.
3. Styles. 4. Section of capsules.
5. Seed.

intermediate fissures. *Seeds* small, spherical, with a rough brown testa and large fleshy strophiola; internally they are white, and consist of a minute embryo lodged in a horny elastic albumen. The flowers appear in September, and the fruit the following spring or summer.

There is a variety, β with late flowers (*floribus serotinis*), growing near Devizes, in Wiltshire, which flowers in the spring.

Florists cultivate several sorts; such as the *white*, the *striped-flowered*, the *striped-leaved*, the *broad-leaved*, the *many-flowered*, and the *double-flowered*.

Hab.—Moist rich meadows in many parts of England and in various countries of Europe.

The plant is propagated by seeds, by a single mature cormus, or by several immature or infant cormi.

COLLECTION OF THE CORMI.—The cormus is biennial. It first appears about the end of June or beginning of July: it flowers in the autumn, and produces its leaves in the spring, and its seed in the June of the following year. It then begins to shrivel, becomes leathery, and finally disappears in the succeeding spring or summer.

The activity of the cormus varies at different seasons of the year. It is usually considered to be greatest when the cormus is about a year old—that is, about the month of July, between

the withering of the leaves and the sprouting forth of the flower of the young cormus. At this period the cormus is fully developed, and has not exhausted itself by the production of the young one. But many of the cormi brought to market have already pushed forth their flowers, which are broken off so as to prevent the

¹ *Synopsis Plant. Floræ Classicæ*, p. 284, 1845.

² Xirobuni, by Col. Baker called "Xezo Vouni," (*Journal of the Geographical Society*, vol. vii. p. 91, 1837.)

³ *Libellus quo demonstratur Colchici Autumnalis Radicem non solum tuto posse exhiberi hominibus, sed et ejus usu interno curari quandoque morbos difficillimos, qui aliis Remedii non cedunt*, 8vo. Vindob. 1763.

⁴ Miller says that, in Warwickshire, the flowers are called *naked ladies*, because they appear without leaves.

circumstance from being observed. "I have seen many cwts.," says Dr. Lindley,¹ "sent to town in this state, which nevertheless found a ready sale, and at the best price."

It is to be dug up in the month of July, or before the autumnal bud shoots up.—*Ph. Lond.*

Dr. Christison² has expressed some doubts as to the propriety of collecting the cormi in July; for though they are plump, firmest, and abound most in starch at this period, yet he has found the shrivelled cormi in the succeeding April to be equally if not more bitter; and he quotes the analyses of Stoltze to show that, while the October cormus yields 2 per cent., the March cormus yields 6 per cent., of bitter extract. But there is an error in the quotation which vitiates the inference intended to be drawn from it. Stoltze found that the October cormus contained 2.17 per cent. of *bitter* extractive, and that the March cormus contained 5.91 of *sweet* extractive matter combined with some bitter extractive; and he concludes that the October cormus is much more active, and contains more bitter extractive, than the spring cormus.

The *seeds* should be gathered when fully ripe. The London market is principally supplied from Gloucestershire, but partly, also, from Hampshire and Oxfordshire.

DESCRIPTION.—The *cormus*, commonly called the *bulb* or *root* (*radix colchici*, *Offic.*), when gathered at the proper season, is about the size of a chestnut, and somewhat resembles in external appearance the bulb of the common tulip (*Tulipa Gesneriana*); which, as well as other liliaceous bulbs, are distinguished from the cormus of colchicum by being composed of laminae or scales, whereas the cormus of colchicum is solid.³ It is rounded on one side—flattened on the other, where is perceived the fibrous germ of a new cormus, which, if allowed to grow, shoots up and bears the flower, while the old cormus wastes. It is covered by two coats—an inner reddish-yellow one, and an external brown one. Internally, the cormus is white, fleshy, solid; contains a milky juice, is very feculent, and has an acrid bitter taste.

DESICCATION.—The slices are to be quickly dried, in a dark airy place, with a heat not exceeding 170° F.⁴

Having removed the outer coats, cut the cormus transversely in thin slices, and dry by a heat which is to be at first gentle, and afterwards slowly raised to 150°.—*Ph. Lond.*

The late Dr. A. T. Thomson⁵ recommended the slices to be dried upon clean white paper *without artificial heat*; but the time required for this is an objection to it in practice. The dried slices (*radix siccata*, *Offic.*) should be about the eighth or tenth of an inch thick, rounded, oval, with one notch only on one part of their circumference (not fiddle-shaped), inodorous, of a grayish-white colour and an amylaceous appearance.

The *seeds* (*semina*) are about the size of those of black mustard, odourless, and have a bitter acrid taste. Their colour is brown, varying from pale to dark or blackish. They somewhat resemble several of the cruciferous seeds (black mustard, turnip, and rape), but are larger than these; moreover, the latter being more oily are more readily crushed. I have known colchicum seeds mistaken for grains of paradise.

COMPOSITION.—The colchicum cormus was analyzed in 1810 by Melander, and Moretti;⁶ in 1818 and 1819, by Stoltze;⁷ and in 1820 by Pelletier and Caventou.⁸

¹ *Flora Medica*, p. 589.

² *Dispensatory*, 2d edit. p. 353.

³ Some years ago, a load of tulip bulbs was delivered at Apothecaries' Hall, London, for colchicum cormi. The late Mr. Anderson, gardener to the Apothecaries' Botanic Garden at Chelsea, for many years cultivated some of these tulips, in commemoration, I suppose, of the attempted fraud.

⁴ *Battley, Lond. Med. Rep.* xiv. 429.

⁵ *Ibid.*, p. 344.

⁶ *Bull. de Pharm.* vol. ii. p. 217.

⁷ *Berlinisches Jahrbuch für die Pharmacie*, Bd. xix. S. 107, 1818; and Bd. xx. S. 135, 1819.

⁸ *Journ. de Pharm.* vi. 364.

ANALYSIS OF

PELLETIER AND CAVENTOU.

Fatty matter { Olein.
 composed of { Stearin.
 { Volatile acid.
 Supergallate of *veratria*.
 Yellow colouring matter.
 Gum.
 Starch.
 Inulin in abundance.
 Lignin.
 Ashes, a minute quantity.

Colchicum cormus.

STOLTZE'S ANALYSES.

Cormi gathered
in March.Ditto,
in October.

Volatile acid matter	trace	rather more
Soft resin	0.04	0.06
Crystallizable sugar	0.41	1.12
Sweet extractive with some bitter extractive	5.91 {	2.72
Difficultly-soluble extractive	1.30	0.52
Gum, like tragacanth	0.81	1.65
Starch	7.46	10.12
Lignin	2.32	1.61
Extractive, soluble in potash	0.61	0.52
Water	51.04	80.31
Colchicum cormus	99.90	100.80

The seeds have been submitted to chemical examination, in 1832, by J. A. Buchner, Jun.,¹ who found in them *fixed oil, free acid, bitter extractive* (impure colchicina), and *resin*.

1. **COLCHICINA**; *Colchicia*; *Colchicene*.—The existence of this principle in colchicum seeds was announced by Geiger and Hesse.² They prepared it by digesting the seeds in boiling alcohol: this dissolved a supersalt, which was precipitated by magnesia, and the precipitate treated with boiling alcohol. By evaporation, colchicina was deposited. The following are said to be its *properties*: It is a crystallizable alkaline substance, without odour, but having a bitter taste. Its hydrate is feebly alkaline, but neutralizes acids, and forms crystallizable salts having a bitter taste. It is soluble in water, and the solution precipitates the solution of chloride of platinum. Nitric acid colours colchicina deep violet, which passes into indigo blue, and quickly becomes first green and then yellow. Concentrated sulphuric acid colours it yellowish brown.

Colchicina is said to be distinguished from veratria by the following characteristics: 1st, it is soluble in water, whereas veratria is not; 2dly, it is crystallizable, whereas pure veratria is not; 3dly, it does not possess the acidity of veratria; and it differs from the latter in this, that, when applied to the nose, it does not excite sneezing, whereas the least portion of [impure] veratria occasions a most convulsive sneezing.

Colchicina is a powerful poison. One-tenth of a grain, dissolved in weak spirit, killed a young cat in about twelve hours. The symptoms were salivation, diarrhœa, vomiting, a staggering gait, cries, convulsions, and death. The stomach and intestines were violently inflamed, and had extravasated blood throughout the whole course.

2. **STARCH**.—The starch grains of the cormus of colchicum are moderately uniform in size: though normally rounded, they present more or less flattened faces, produced by their mutual compression in the cells of the plant, by which they have acquired a polygonal appearance. Many are mullar-shaped, some are dihedral at one end, others trihedral; owing to the mutual pressure of two, three, or four particles. The hilum is usually stellate.

CHEMICAL CHARACTERISTICS. *a. Of the Cormi*.—The decoction of the fresh cormi, when cold, forms, with a solution of iodine, a deep blue precipitate (*iodide of starch*); with sesquichloride of iron, a faint bluish tint (*gallate of iron*); with diacetate of lead, or protonitrate of mercury, a copious white precipitate; with nitrate of silver, a precipitate which is at first white, but becomes in a few minutes black; with tincture of nutgalls, a very slight, dirty-looking precipitate, which is somewhat diminished by the effect of heat [Pelletier and Caventou³ regard this precipitate as a mixture of the *tannates of starch* and *inulin*⁴ (and of veratrin?)]; and with a solution of gelatine, a slight haziness. Fresh-prepared tincture of guaiacum, with a few drops of acetic acid, produces a cerulean blue colour with the fresh cormus, indicating the presence of gluten.

β. Of the Seeds.—The decoction of the seeds, when cold, yields, with oxalate of ammonia, a white precipitate (*oxalate of lime*); with diacetate of lead, a copious white precipitate; and, with nitrate of silver, a precipitate. If the decoction be concentrated, and poured into alcohol, a gelatiniform precipitate is produced.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables*.—Not yet determined.

β. On Animals.—Colchicum is a poison to animals. It acts as a local irritant,

¹ *Repert. für die Pharm.* Bd. xliiii. S. 376, 1832.² *Journ. de Chim.* x. 465.³ *Journ. de Pharm.* vi. 365.⁴ The precipitate produced in an amylaceous decoction by infusion of nutgalls, disappears when the liquor is gradually heated to 122° F.: but if inulin be present, it does not disappear until the liquor has reached the boiling point.

reduces the force of the circulation, and causes inflammation of the alimentary canal. Animals, for the most part, refuse to feed on it. It has, however, been eaten by deer and cattle, and proved poisonous to them.¹ It is said to prove injurious at spring-time only.² Moreover, we are told that when dry it may be eaten in hay with impunity. Störck³ and Kratochwill⁴ gave it to dogs, on whom it acted as an acrid poison, and caused death. Sir E. Home⁵ injected 160 drops of a vinous infusion of colchicum into the jugular vein of a dog: all power of motion was instantly lost, the breathing became slow, the pulse hardly to be felt. In ten minutes it was 84, in twenty minutes 60, in an hour 115, with the respiration so quick as scarcely to be counted. In two hours the pulse was 150, and very weak. The animal was purged, vomited, and very languid: he died in five hours. On dissection, the internal coat of the stomach was found inflamed, in a greater or less degree, universally. From this experiment it appears that the action of colchicum on the alimentary canal is of a specific kind.

In opposition to the above statements, it deserves notice that Orfila⁶ has frequently given to dogs, in the month of June, two or three cormi without perceiving any sensible effects; from which he infers that climate and season of the year have great influence on their deleterious properties.

It has been said that horses eat colchicum with impunity; but it is probable that this statement is erroneous. Withering⁷ states, on the authority of Mr. Woodward, that, "in a pasture in which were several horses, and eaten down nearly bare, the grass was closely cropped, even under the leaves, but not a leaf bitten."

Some further information on the effects of colchicum on dogs will be found in Sir C. Scudamore's *Treatise on Gout and Rheumatism*, 3d edit. p. 477, 1819.

γ. *On Man.*—Colchicum is acrid and sedative. Taken internally, in small and repeated doses, it promotes the action of the secreting organs, especially the intestinal mucous membrane. The kidneys, the skin, and the liver, are less certainly and obviously affected by it. Salivation has been ascribed to it by Dr. Aldridge.⁸ The most constant effects observed from the use of larger doses are nausea, vomiting, and purging. Reduction of the frequency of the pulse is a common, though not an invariable effect. Mr. Haden⁹ was, I believe, the first to direct attention to the advantages to be taken of this effect in the treatment of inflammatory diseases. In some experiments made on healthy individuals by Dr. Lewins,¹⁰ debility, a feeling of illness, and headache, were experienced. This feeling of debility is not, however, to be referred to the evacuations produced; for, as Dr. Barlow¹¹ has observed, the number of motions is sometimes considerable without any proportionate depression of strength ensuing. "I have known," says Dr. B., "even twenty stools occasioned by a single dose of colchicum, the patient not complaining of the least debility." The action of colchicum on the secretory apparatus is not confined to that of the alimentary canal: after the use of three or four full doses of this medicine, copious sweating is often produced, especially when the skin is kept warm. On other occasions, the kidneys are powerfully acted on. In one case, mentioned by Dr. Lewins, seventy drops of *Vinum Colchici* caused the discharge of upwards of a pint of bile by vomiting. Violent salivation resulted, in a case recorded in an American journal.¹² Chelius, of Heidelberg,¹³ asserts that, in gout and rheumatism, colchicum occasions a striking increase in the quantity of uric acid contained in the urine: in one case it was nearly doubled in the space of twelve days. But this effect is by no means constant, as Dr. Graves¹⁴ has pointed out. Indeed, it some-

¹ Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. ii. 150.

² Haquet, in Wibmer, *op. cit.*; also, Want, *Lond. Med. and Phys. Journal*, vol. xxxii. p. 216.

³ *Lib. de Colchico*, p. 17.

⁴ *Phil. Trans.* 1816.

⁵ *Brit. Plants*, ii. 462, 7th edit. 1830.

⁶ *Practical Observations on the Colchicum autumnale*, 1820.

⁷ *Edinburgh Medical and Surgical Journal*, vol. xlvii. p. 345, 1837.

⁸ *Cyclopædia of Practical Medicine*, art. Gout, vol. ii. p. 371.

⁹ Wood and Bache's *United States Dispensatory*, 3d edit.

¹⁰ *Lond. Med. Gaz.* vol. ii. p. 830.

¹¹ *Ibid.*, vol. vii. p. 548.

¹² *Toxicol. Gén.*

¹³ *Dublin Hospital Gazette*, p. 52, Oct. 1845.

times happens, in acute rheumatism, when the urine is loaded with uric acid or the urates, that under the use of colchicum the quantity of these matters in the urine is diminished; so that it would seem rather to prevent the formation of uric acid in the system than to provoke its elimination.

In *excessive* or *poisonous doses* colchicum acts as a powerful poison. In a case related by Mr. Fereday,¹ where two ounces of the wine of the seeds of colchicum were swallowed, the symptoms were acute pain in the bowels, coming on in about an hour and a half after taking it, vomiting, acute tenesmus, small, slow, and feeble pulse, cold feet, and weakness of limbs. The nausea, vomiting, and pain in the stomach continued with undiminished violence, the pulse became also imperceptible and intermitting, the urine was suppressed, the respiration hurried, purging of copious liquid stools came on, and loss of sight for a minute or two after getting out of bed. The patient died forty-seven hours after swallowing the poison. On a *post-mortem* examination, the skin of most parts of the body was found to be covered with a purple efflorescence: no inflammation was observed in the alimentary canal; two red patches were found, one in the stomach, and the other in the jejunum. These were produced by the effusion of a small quantity of blood, in the one case, between the muscular and mucous coats; in the other, between the peritoneal and muscular coats. Ecchymosed spots were observed on the surface of the lungs, of the heart, and of the diaphragm. More recently, a case of poisoning by a decoction of the seeds has been recorded;² as, also, by the leaves of this plant.

In Mr. Fereday's case, the only indications of an affection of the nervous system were weakness of the limbs, the temporary loss of sight, and the slowness and feebleness of the pulse.

It is deserving of notice that, in this case, also in another related by Chevallier,³ likewise in a third mentioned by Mr. Dillon,⁴ and in Mr. Haden's case,⁵ no convulsions were observed; and, in the first three cases, no insensibility. In the last case, however, Mr. Haden mentions that at "ten P. M. she fell into an apoplectic kind of sleep, which terminated in death before morning." It is remarkable that convulsions are ascribed to veratria by Magendie, and to colchicina by Geiger and Hesse. In one case of fatal poisoning from an ounce and a half of the tincture of colchicum,⁶ delirium occurred.

It is a popular notion that colchicum acts as an emmenagogue; and hence it is sometimes used to produce abortion. Several poisonous cases of its use for this purpose have occurred.

Some persons appear to be peculiarly susceptible of the influence of colchicum. In Mr. Haden's case, Zijss of tincture of colchicum caused death in a female whose mother was also exceedingly susceptible of the action of colchicum in even very small doses. In a case related by Mr. Mann,⁷ Zijss of the wine of colchicum in divided doses caused death on the fourth day.

The above account of the effects of colchicum applies both to the *cormi*, the *seeds*, and the *leaves*. The *flowers* are likewise poisonous, and a fatal case from their use is mentioned by Dr. Christison.⁸ They have been recommended for medicinal use.

USES.—The following are the principal diseases in which the Meadow Saffron has been employed:—

1. In *Gout*.—The circumstances which of late years have led to the extensive employment of colchicum in gout are the following: About seventy years ago, M. Husson, a military officer in the service of the king of France, discovered, as he informs us, a plant possessed of extraordinary virtues in the cure of various diseases. From this plant he prepared a remedy called *Eau Médicinale*, which acquired great celebrity for abating the pain and cutting short the paroxysm of

¹ *Lond. Med. Gaz.* vol. x. p. 160.

² *Ibid.*, viii. 351.

³ *Magendie's Formulary*, by C. T. Haden.

⁴ *Edinburgh Medical and Surgical Journal*, xiv. 262.

⁵ *Taylor, On Poisons*.

⁶ *Journ. de Chim. Méd.* t. vi. 2de Série, p. 505.

⁷ *Stephenson and Churchill's Med. Bot.* vol. ii.

⁸ *Treatise on Poisons*, 3d edit. p. 792.

gout.¹ Various attempts were made to discover the nature of its active principle. In 1782, MM. Cadet and Parmentier declared that it contained no metallic or mineral substance, and that it was a vinous infusion of some bitter plant or plants. Alyon² asserted that it was prepared with Gratiola; Mr. Moore³ that it was a vinous infusion of white hellebore with laudanum; Mr. Want⁴ that it was a vinous infusion of colchicum. Although most writers have adopted Mr. Want's opinion, we should bear in mind that the proofs hitherto offered of its correctness, viz., analogy of effect, cannot be admitted to be conclusive, as is well shown by the fact that they have been advanced in favour of the identity of other medicines with the *Eau Médicinale*.

The power of colchicum to alleviate a paroxysm of gout is admitted by all; but considerable difference of opinion exists as to the extent of this power, and the propriety of employing it. Sir Everard Home,⁵ from observation of its effects on his own person, regarded it as a specific in gout, and from experiments on animals concluded that its beneficial effects in this malady are produced through the circulation.

Dr. Paris⁶ observes: "As a *specific* in gout its efficacy has been fully ascertained; it allays pain, and cuts short the paroxysm. It has also a decided action upon the arterial system, which it would appear to control through the medium of the nerves." But if by the word *specific* is meant a medicine infallibly, and on all patients, producing given salutary effects, and acting by some unknown power on the disease, without being directed by indications,⁷ undoubtedly colchicum is no *specific* for gout.

That colchicum alleviates a paroxysm of gout, I have before mentioned; but that alleviation is palliative, not curative. It has no tendency to prevent a speedy recurrence of the attack; nay, according to Sir Charles Scudamore,⁸ it renders the disposition to the disease much stronger in the system. Furthermore, by repetition its power over gouty paroxysms becomes diminished.

The *modus medendi* of colchicum in gout is an interesting, though not very satisfactory part of our inquiry. I have already stated that some regard this remedy as a *specific*; that is, as operating by some unknown influence. Others, however, and with more propriety, refer its therapeutical uses to its known physiological effects. "Colchicum," says Dr. Barlow,⁹ "purges, abates pain, and lowers the pulse. These effects are accounted for by assigning to it a cathartic and sedative operation; and it is this combination, perhaps, to which its peculiar virtues are to be ascribed." The fact that a combination of a drastic and a narcotic (as elaterium and opium, mentioned by Dr. Sutton,¹⁰ and white hellebore and laudanum, recommended by Mr. Moore)¹¹ has been found to give, in several cases of gout, marked and speedy relief, seems to me to confirm Dr. Barlow's opinion. The idea entertained by Chelius, and adopted by Dr. G. Hume Weatherhead,¹² that colchicum relieves gout by augmenting the quantity of uric acid in the urine, is not supported by fact, as I have already mentioned. Whether it acts by preventing the formation of uric acid in the system, I am not prepared to say.

In acute gout occurring in plethoric habits, blood-letting should precede the use of colchicum. This medicine should then be exhibited in full doses, so as to produce a copious evacuation by the bowels, and then the quantity must be considerably diminished. Though purging is not essential to the therapeutical influence of colchicum, it is admitted by most that, in a large number of cases at least, it promotes the alleviation of the symptoms. Hence, many practitioners recommend its com-

¹ Dr. F. G. Jones, *An Account of the Remarkable Effects of the Eau Médicinale d'Husson in the Gout*.

² *Élém. de Chimie*.

³ *Two Letters on the Composition of the Eau Médicinale*, 2d edit. 1811.

⁴ *Med. and Phys. Journal*, vol. xxxii. 1814.

⁵ *Phil. Trans.* 1816.

⁶ *Pharmacologia*, 6th edit. vol. ii. p. 175.

⁷ Vide Dr. Parr's *Lond. Med. Dict. art. Specifica*.

⁸ *Treatise on Gout and Rheumatism*, 3d edit. p. 197.

⁹ *Cyclopædia of Practical Medicine*, art. Gout, vol. ii. p. 372.

¹⁰ *Tracts on Gout*, p. 201.

¹¹ *Op. cit.*

¹² *Treatise on Headaches*, p. 88, 1835.

bination with saline purgatives, as the sulphate of magnesia. Sir Charles Scudamore has experienced "the most remarkable success from a draught composed of *Magnesiæ* gr. xv ad xx; *Magnes. Sulphat.* ʒj ad ʒij; *Aceti Colchici* ʒj ad ʒij; with any distilled water the most agreeable, and sweetened with any pleasant syrup, or with 15 or 20 grains of Extract. Glycyrrhiz."

2. *In rheumatism.*—The analogy existing between gout and rheumatism has led to the trial of the same remedies in both diseases. But its therapeutical powers in the latter disease are much less marked than in the former. Rheumatism may affect the fibrous tissues of the joints, the synovial membrane, the muscles or their aponeurotic coverings, the periosteum, or the neurilemma, constituting thus five forms of the disease, which may be denominated respectively the *fibrous* or *ligamentous*; the *synovial*, *arthritic*, or *capsular*; the *muscular*; the *periosteal*; and the *neurathic* forms of rheumatism.¹ Of these, colchicum is said to produce its best effects in the synovial form. It is remarkable, however, that in all the severe cases of this variety of rheumatism which have fallen under my notice, the disease has proceeded unchecked, or was scarcely relieved by the use of colchicum. In one instance, that of my much-lamented friend, the late Dr. Cummin (whose case is noticed by Dr. Macleod, in the *Lond. Med. Gaz.* xxi. 358), the disease proved fatal by metastasis to the brain. In another melancholy, but not fatal case, the gentleman lost the sight of both his eyes, and has both knee-joints rendered stiff. In neither of these cases was colchicum of the slightest avail.

Of the mode of administering colchicum in "rheumatic gout," recommended by Mr. Wigan,² I have no experience. He gives eight grains of the powder in some mild diluent every hour until active vomiting, profuse purging, or abundant perspiration take place; or, at least, till the stomach can bear no more. The usual quantity is eight or ten doses; but, while some take fourteen, others can bear only five. Though the pain ceases, the more active effects of the colchicum do not take place for some hours after the last dose. Thus administered, Mr. Wigan declares colchicum "the most easily managed, the most universally applicable, the safest, and the most certain specific in the whole compass of our opulent Pharmacopœia." But its use in these large doses requires to be carefully watched.

3. *In dropsy.*—Colchicum was used in dropsy with success by Störck.³ It has been employed in dropsical cases with the twofold view of purging and promoting the action of the kidneys. Given in combination with saline purgatives, I have found it beneficial in some cases of anasarca of old persons.

4. *In inflammatory diseases generally.*—Colchicum was recommended as a sedative in inflammatory diseases in general by the late Mr. C. T. Haden.⁴ He used it as an auxiliary to blood-letting, for the purpose of controlling arterial action; and gave it in the form of powder, in doses of six or seven grains, three or four times daily, in combination with purgatives, in inflammatory affections of the lungs and their membranes, and of the breasts and nipples. In chronic bronchitis it has also been found useful by Dr. Hastings.⁵

5. *In fevers.*—The late Mr. Haden,⁶ and more recently Dr. Lewin,⁷ have spoken favourably of the use of colchicum in fever. In my opinion, it is only admissible in those forms of the disease requiring an active antiphlogistic treatment. In such it may be useful as an auxiliary to blood-letting and cathartics.

6. *In various other diseases.*—For expelling tape-worm, colchicum has been found efficacious by Chisholm and Baumbach. In some chronic affections of the nervous system, as chorea, hypochondriasis, hysteria, &c., Mr. Raven⁸ employed it with advantage. In humoral asthma, and other chronic bronchial affections, I have

¹ Dr. Macleod, *Lond. Med. Gaz.* xxi. 120.

² *Lond. Med. Gaz.* June 30, 1838.

³ *Practical Observations on the Colchicum autumnale*, 1820.

⁴ *Treatise on Inflammation of the Mucous Membrane of the Lungs*, 1820.

⁵ *Edinburgh Medical and Surgical Journal*, April, 1837.

⁶ *London Medical and Physical Journal*, Jan. 1817.

⁷ *Libellus*.

⁸ *Op. cit.*

found it of great service, especially when these complaints were accompanied with anasarca swellings.

ADMINISTRATION.—The cormi and seeds of meadow saffron have been employed in substance, in a liquid form, and in the state of extract.

1. PULVIS CORMI COLCHICI.—Dose, from two to eight or nine grains. To preserve it, Mr. Wigan recommends it to be kept mixed with sugar.

2. PULVIS SEMINUM COLCHICI.—Dose the same as that of the cormus. The seeds are to be preferred to the cormi, as being more uniform in their properties.

3. TINCTURA [SEMINUM] COLCHICI, L. Ed.; *Tinctura Seminum Colchici*, D. [*Tinctura Colchici Seminis*, U. S.].—(Meadow Saffron seeds, bruised [ground finely in a coffee-mill, *Ed.*], $\mathfrak{z}\text{v}$; Proof Spirit Oij. Macerate for seven [fourteen, *D.*] days, and strain, *L.* “Percolation is much more convenient and speedy than digestion,” *E.*—[Colchicum seed, bruised, four ounces; diluted alcohol two pints. Macerate for fourteen days, express and filter through paper, or moisten the powder with the diluted alcohol, allow to stand for twenty-four hours, and then displace, *U. S.*]—Dr. Williams¹ objected to this preparation as being “turbid, unpalatable, and disposed to precipitation.” The same writer² also asserts that the active property of the seeds resides in their husk or cortical part, and, therefore, protests against bruising them. But were his assertion correct (and it is most improbable that the embryo is devoid of activity), bruising them cannot destroy or injure their activity. The average dose is from $\mathfrak{f}\mathfrak{z}\mathfrak{ss}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{j}$. I have repeatedly given $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{j}$ at a dose without any violent effect. Dr. Barlow, who prefers this to the other preparations of colchicum, advises that in gout a drachm, a drachm and a half, or two drachms of the tincture should be given at night, and repeated the following morning. If this quantity fail to purge briskly, a third dose may be administered the ensuing night. Externally, the tincture has been employed as a liniment to relieve rheumatic, gouty, venereal, and other pains.³

4. TINCTURA [SEMINUM] COLCHICI COMPOSITA, L.; *Spiritus Colchici ammoniatus*, L. 1824.—(Meadow Saffron seeds, bruised, $\mathfrak{z}\text{v}$; Aromatic Spirit of Ammonia Oij. Macerate for seven days, then express and strain.) Dose $\mathfrak{m}\mathfrak{x}\mathfrak{x}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{j}$.—This preparation was recommended by Dr. Williams as being “of greater value when acidity or flatulence prevails than the *Vin. sem. Colchici*, and better adapted to the palates of those who object to the flavour of white wine.” It is seldom employed. Mr. Brande⁴ says doubts are entertained as to the propriety of employing ammonia in it.

5. VINUM SEMINUM COLCHICI [*Vinum Colchici Seminis*, U. S.].—No formula for this exists in any of the British pharmacopœias. The following is Dr. Williams’s formula: Meadow Saffron seeds, dried, $\mathfrak{z}\mathfrak{i}\mathfrak{j}$; Sherry Wine Oj (*wine measure*). Macerate for eight or ten [fourteen] days, occasionally agitating, then filter. The average dose is $\mathfrak{f}\mathfrak{z}\mathfrak{ss}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{j}$. I have given it to the extent of $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{j}$. Dr. Williams says it may be gradually increased to $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{j}$.

[This formula has been adopted by the *U. S. Pharmacopœia*, which directs double the proportion of each of the ingredients, and directs maceration for fourteen days.]

6. VINUM [CORMI] COLCHICI, L. E. [*Vinum Colchici Radicis*, U. S.].—(Meadow Saffron cormus, dried and sliced, $\mathfrak{z}\mathfrak{v}\mathfrak{i}\mathfrak{j}$; Sherry Wine Oij. Macerate for seven days [express strongly the residuum, *E.*], and strain.) [The directions of the *U. S. Pharm.* are: Take of Colchicum Root one pound; White Wine two pints. Macerate for fourteen days, with occasional agitation, and filter; or by displacement.] Average dose $\mathfrak{f}\mathfrak{z}\mathfrak{ss}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{j}$.—Sir E. Home⁵ thought that the second and subsequent deposits

¹ *London Med. Rep.* vol. xiv. p. 93.

² *Op. cit.* vol. xv. p. 442.

³ *Lancet*, *London-Medical Gazette*, vol. xxiii. p. 899; and vol. xxiv. 388.

⁴ *Duct. of Mat. Med.* 1839.

⁵ *Phil. Trans.* 1837.

which take place from this wine contain the principle which acts on the stomach and bowels, while that which cures the gout is retained in permanent solution. But Sir C. Scudamore¹ found the sediment to be inert.

7. **ACETUM [CORMI] COLCHICI**, L. E. D. [U. S.].—(Meadow Saffron cormus, dried [and bruised, *D.*], \mathfrak{z} iiiss [\mathfrak{z} j, *D.*]; Dilute Acetic Acid Oj [Acetic Acid of commerce (sp. gr. 1044) $\mathfrak{f}\mathfrak{z}$ iv; Distilled Water \mathfrak{z} xij, *D.*]; [Proof Spirit $\mathfrak{f}\mathfrak{z}$ iss, *L.*]. Macerate the colchicum in the acid [diluted with the water, *D.*], in a covered vessel, for three [seven, *D.*] days; then express, set aside for the feces to subside, and strain. [To the strained liquor, add the spirit, *L.*].—The *Edinburgh College* directs colchicum-bulb, fresh and sliced, \mathfrak{z} j; Distilled Vinegar $\mathfrak{f}\mathfrak{z}$ xvj; Proof Spirit $\mathfrak{f}\mathfrak{z}$ j).—The London and Dublin Colleges, in their Pharmacopœias for 1850, have very properly substituted the *dried* for the *fresh* cormus ordered in the preceding Pharmacopœia, on account of the impossibility of procuring the fresh at all seasons of the year. [The *U. S. Pharm.* orders of Colchicum Root, bruised, two ounces; Diluted Acetic Acid two pints. Macerate the root with the diluted acetic acid, in a close glass vessel, for seven days; then express the liquor and set it by, that the dregs may subside; lastly, pour off the clear liquor.].—In practice, one part of the dried cormus may be considered equal to three parts of the fresh: for Mr. Battley says the cormus loses about 67 per cent. of its weight in drying; and Mr. Bainbridge² obtained 2 lbs. 15 oz. of dried slices from 8 lbs. of fresh cormi. The proof spirit used in preparing the acetum is for the purpose of checking decomposition. By the action of the acetic acid on the colchicina of the cormus, an acetate of this alkaloid is obtained. Sir C. Scudamore³ regards an acetic preparation of colchicum as milder than the wine or tincture made with the same relative weights of cormi and liquids, though it is a most efficient preparation in gout. He advises, as I have before mentioned, that it should be given in combination with magnesia, by which its acid menstruum is destroyed (acetate of magnesia being formed), and the active principle of the colchicum left in the most favourable state for administration. The average dose is from $\mathfrak{f}\mathfrak{z}$ ss to $\mathfrak{f}\mathfrak{z}$ ij.

8. **EXTRACTUM [CORMI] COLCHICI ACETICUM**, L. E. D. [U. S.].—(Fresh Meadow Saffron cormus, \mathfrak{H} j; Acetic [pyroligneous, *Ed.*] Acid $\mathfrak{f}\mathfrak{z}$ ij. Bruise the cormus gradually sprinkled with the acetic acid, then press out the juice, and evaporate it in an earthen vessel which is not glazed with lead [over the vapour-bath, *Ed.*] to a proper consistence. The *Dublin College* orders of Colchicum Root, dried, \mathfrak{z} iv; Dilute Acetic Acid $\mathfrak{f}\mathfrak{z}$ vij. Digest the root in the acid for fourteen days, then filter, and evaporate, by means of a water-bath, to the consistence of a soft extract. [Take of Colchicum Root, in coarse powder, a pound; Acetic Acid four fluid-ounces; Water a sufficient quantity. To the acetic acid add a pint of water, and mix the resulting liquid with the colchicum root. Transfer the mixture to a percolator, and pour water gradually upon it until the liquid passes with little or no taste. Lastly, evaporate the liquid in a porcelain vessel to the proper consistence. *U. S.*].—This compound contains the acetate of colchicina. It is a very favourite remedy in the treatment of gout and rheumatism, and was introduced into practice by Sir C. Scudamore. Dr. Paris⁴ observes that he has “found it useful in promoting healthy discharges of bile.” He occasionally combines it with blue pill, calomel, or potassio-tartrate of antimony. The dose is from gr. j to gr. iij twice or thrice a day.

9. **EXTRACTUM COLCHICI [CORMI]**, L.—(Fresh Meadow Saffron cormus \mathfrak{H} j. Bruise the cormus, sprinkled with a little water, in a stone mortar; then press out the juice, and evaporate it, unstrained, to a proper consistence.)—This is a favourite

¹ *Treatise on Gout*, 3d edit. p. 513.

² Haden, *Practical Observations on Colchicum autumnale*, p. 77.

³ *Observations on the Use of Colchicum*.

⁴ *Appendix to the Eighth Edition of the Pharmacologia*.

² *London Med. Gaz.* xii. 463.

preparation with Dr. Hue, of St. Bartholomew's Hospital, in the early stage of acute rheumatism. The dose is gr. j every four hours.

10. SUCCUS COLCHICI; Preserved Juice of Colchicum.—I am informed that in one experiment from one cwt. of very fine cormi gathered at the end of August, and well bruised and pressed, four imperial gallons and f 3xij of a light fawn-coloured juice were obtained. This juice becomes darker coloured by exposure to the air. After standing forty-eight hours the spirit is added to it. A large quantity of feculent deposit is formed, and the liquor acquires a paler tint. The deposit by boiling yields a coagulum. Exposure to light appears to render it somewhat paler. The smallest dose of succus colchici is five minims.

ANTIDOTE.—See VERATRUM ALBUM.

56. Hermodactylus, Auct.—Hermodactyl.

HISTORY.—Among the later Greek and the Arabian physicians, a medicine called hermodactyl (ἡρμωδάκτυλος, from Ἑρμῆς, *Mercury* or *Hermes*; and δάκτυλος, *a finger*) was in great repute as a remedy for arthritic diseases. It was first mentioned by Alexander of Tralles,¹ who flourished A. D. 560. Paulus Ægineta,² who lived A. D. 650, Avicenna,³ Serapion,⁴ and Mesue,⁵ also speak of it. It is deserving of especial notice, that, under the name of *Surugen* or *Hermodactyl*, Serapion comprehends the *καλχικόν* and *εφήμερον* of Dioscorides, and the ἡρμωδάκτυλος of Paulus. By some of the old writers, hermodactyl was called *anima articulorum*, or the soul of the joints.

NATURAL HISTORY.—The cormi brought from Oriental countries in modern times under the name of hermodactyls, answer to the descriptions given of the ancient substance bearing this name. I am, therefore, induced to believe them to be identical with the latter. Their resemblance to the cormi of *Colchicum autumnale* leads me to reject the notion of Matthioli, at one time entertained by Linnæus,⁶ and adopted by Martius⁷ and Fraas,⁸ that they are produced by *Iris tuberosa*. That they are the underground stems of some species of *colchicum* can scarcely, I think, be doubted by any one who carefully examines them. Notwithstanding the statements of Mr. Waut⁹ and of Sir H. Hallford,¹⁰ I cannot admit the assumption that hermodactyls are the cormi of *Colchicum autumnale*, though this is the only species of *Colchicum* admitted into the new Greek Pharmacopœia. Though resembling the latter in several circumstances, they possess certain distinctive peculiarities. Some of the most eminent pharmacologists of Europe (e.g. Guibourt, Goebel, Geiger, Geoffroy, &c.) also regard them as distinct. The *Colchicum illyricum*, mentioned in many works as yielding hermodactyl, is unknown to modern botanists. The cormus of *Colchicum byzantinum* is too large to be confounded with hermodactyl. *Colchicum variegatum* has been supposed by several botanists and pharmacologists to be the source of hermodactyl, but further evidence is required to establish the opinion. This plant is a native of Sicily, Crete, Greece, and Portugal. Dr. Sibthorp¹¹ found it on Helicon, Parnassus, and other mountains of Greece. It is not improbable, I think, that *Colchicum bulbocodiodes* may yield hermodactyl, which Dale¹² tells us is brought from Syria. Dr. Lindley informs me that this species was found by Colonel Chesney near the Euphrates, where it was very common, flowering in March. The cormi were not brought over. *Iris tuberosa* was not found there. Forskål¹³ found *Colchicum montanum* (which Sprengel, in his *Syst. Veg.*, regards as identical with *C. bulbocodiodes*) at Kurma, in Arabia.

DESCRIPTION.—Mesue says that hermodactyl is either long, like the finger, or round. Of the round, he adds, there are three kinds—the white, the red, and the black; the white being the best. C. Bauhin¹⁴ considered that the black and red hermodactyl of Mesue and Serapion are *C. autumnale*, or, as he terms it, "*Colchicum commune*;" but the white hermodactyl he regarded as a distinct kind, which he calls "*Colchicum radice siccata alba*." Through the kindness of my friend Professor Royle, I have had the examination of two kinds of hermodactyl, procured by him in the bazaars of Northern India, brought, he thinks, from Surat or Bombay, and probably imported there from the Red Sea.

1. *Tasteless Hermodactyl; Sorinjan sheeran* (i. e. sweet sorinjan), Royle; *Hermodactylus*, Auct. nostræ atatis.—In their general form these cormi resemble those of *Colchicum autumnale*. They are flattened, cordate, hollowed out or grooved on one side, convex on the other. At

¹ Lib. xi.

² *Opera*, lib. iii. cap. 78; also, Adams's Translation for the Sydenham Society, vol. i. p. 660; and vol. iii. pp. 114 and 195.

³ Lib. ii. cap. 392.

⁴ *Opera*, p. 37, ed. Bonon. 1484.

⁵ *Pharmacognosia*, 42.

⁶ *Med. and Phys. Journal*, vol. xxxii.

⁷ *Prod. Fl. Græcæ*, ii. 350.

⁸ *Fl. Egypt. Arab.* p. 77.

⁴ *De simplicibus*, cap. 194.

⁶ Murray, *App. Med.* vol. v. p. 215.

⁸ *Syn. Plant. Fl. Classicæ*, p. 293, 1845.

¹⁰ *London Medical Gazette*, vol. viii. p. 318.

¹² *Pharmacologia*, p. 245, ed. 3tia.

¹³ *Pinax*, p. 67, 1671.

their lower part (forming the base of the heart) is a mark or disk for the insertion of the root fibres. Their size varies: the specimens I have examined were from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in length or height, 1 to $1\frac{1}{2}$ inches in breadth, and about $\frac{1}{2}$ an inch in depth. They have been deprived of their coats, are externally dirty yellow or brownish, internally white, easily broken, farinaceous, opaque, odourless, tasteless, or nearly so, and worm-eaten. They agree precisely with hermodactyls furnished me by Professor Guilbort. They are readily distinguished from the corni of *Colchicum autumnale* by the following characters, which are correctly stated by Godfrey.¹ They are not rugose, are white internally, are moderately hard, easily broken, and form a whitish powder; whereas the dried corni of *Colchicum autumnale* are rugose, softer, and have a reddish or grayish tint both internally and externally.

2. *Bitter Hermodactyl*; *Sorinjan tulkh* (i. e. bitter sorinjan), Royle. ? *Bulbs [corni] of another Colchicum*.² ? ? *Hermodactylus rubens et niger* (Avicenna and Mesue).—The corni of this variety are distinguished from the preceding by their bitter taste, their smaller size, and by having externally a striped or reticulated appearance. Their colour for the most part is darker; in some specimens it is blackish. One cornus is ovate-cordate; 1 inch in height or length, $\frac{1}{2}$ of an inch broad, and about $\frac{1}{4}$ of an inch thick, grooved or hollowed on one side, convex on the other; of a brownish-yellow colour, semi-transparent, has a horny appearance, and is marked by longitudinal stripes, indicating a laminated structure. A second is opaque, amylaceous, reticulated externally, white internally, less flattened, and of a remarkable shape, the concave or hollow side of the cornus being continued half an inch below the mark for the attachment of the root fibres. The other corni are of the size and shape of a large orange pip, but flattened or grooved on one side; some of them are worm-eaten, and one is blackish-brown externally.

COMPOSITION.—Lecanu³ analyzed hermodactyls (the tasteless variety), and obtained the following results: *Starch* (forming the principal constituent of the hermodactyl), *fatty matter*, *yellow colouring matter*, *gum*, *supermalates of lime* and *potash*, and *chloride of potassium*.

Is the absence of veratria or colchicina to be ascribed to the corni having undergone decomposition by keeping? No inulin was detected.

CHEMICAL CHARACTERISTICS.—Both the tasteless and bitter hermodactyls are blackened by tincture of iodine, showing the presence of starch. A cold decoction of the bitter variety produced an intense blue precipitate (*iodide of starch*) with a solution of iodine. Tincture of galls, and solutions of protonitrate of mercury, and of diacetate of lead, caused a cloudiness in the cold decoction.

EFFECTS AND USES.—No modern experiments have been made to determine the activity of hermodactyl. The tasteless variety is probably inert, or nearly so; but the bitter variety, I suspect, possesses some activity. Is its operation analogous to that of the cornus of *Colchicum autumnale*?

Speaking of the treatment of gout and arthritis, Paulus says: "Some, in the paroxysms of all arthritic diseases, have recourse to purging with hermodactylus; but it is to be remarked that the hermodactylus is bad for the stomach, producing nausea and anorexia, and ought, therefore, to be used only in the case of those who are pressed by urgent business, for it removes rheumatism speedily, and after two days at most, so that they are enabled to resume their accustomed employment."⁴

57. VERATRUM ALBUM, Linn.—WHITE HELLEBORE.

Sec. Syst. Polygamia, Monœcia.
(Rhizoma, L.—Rhizoma, E.)

HISTORY.—This is, I think, the *ἰνκίβρογος λευκός* of Dioscorides (lib. iv. cap. 150), and probably, therefore, of other ancient writers, as Hippocrates and Theophrastus. On this point, however, considerable difference of opinion has existed. Schulze,⁵ while he acknowledges the great similitude between *Veratrum album*, Linn. and the white hellebore of Dioscorides, is of opinion that the true hellebore (both white and black) of Theophrastus is wholly lost. And Dr. Sibthorp,⁶ who found both *V. album* and *V. nigrum* in Greece,⁷ regards *Digitalis ferruginea* as the white hellebore of Dioscorides—an opinion from which Sir J. Smith, the editor of the *Prodromus*, expresses his dissent.⁸ The term *veratrum* is said by Lemery to be derived

¹ *Trait. de Mat. Méd.* t. ii. p. 79.

² *Journ. de Pharm.* xi. 350.

³ *Adams's Translation*, vol. i. p. 660, Sydenham Society's edition.

⁴ *Diss. inaug. sist. Toxicol. Veterum*, Hake, 1785.

⁵ *Prod. Fl. Græcæ*, i. 439.

⁶ Neither Fraas, nor any other botanists, whose collections in Greece he examined, found either of the above-mentioned species of *veratrum*.

⁷ For some interesting information respecting the ancient hellebore, consult Dierbach, *Arzneimittel*, d. Hippocrates, p. 107.

from *vere atrum* (*truly black*), in reference to the colour of the rhizome; but this etymology is improbable.

BOTANY.—**Gen. Char.**—*Flowers* polygamous. *Perianth* six-parted; segments broad, concave, imbricating, nearly equal, striated, not excavated at the base. *Stamens* six, equal, inserted into the base of the segments; *filaments* subulate; *anthers* reniform, with confluent cells. *Ovary* with three divaricating *stigmas*. *Capsule* three-horned, separating into three many-seeded follicles. *Seeds* compressed, winged at the apex. (*Lindley*.)

Sp. Char.—*Panicle* decomposed. *Bracts* equalling the flowers. *Pedicels* pubescent. *Segments of the perianth* somewhat erect and obtuse, serrulate. *Leaves* ovate-oblong, plaited. (*Sprengel*.)

Root composed of numerous fleshy brownish-white fibres, arising from a perennial, cylindrical, fleshy, subterraneous stem or *rhizome*, which is brown externally, brownish-white internally, and is placed obliquely in the earth. *Stem* one to four feet high. The plant flowers from June to August.

Two varieties (by some considered distinct species) are included here:—

a. albiflorum (*V. album*, Bernh.) with decomposed raceme and white flowers.

β. viridiflorum (*V. Lobelianum*, Bernh.) with compound raceme and greenish flowers.

Hab.—Mountainous regions of Europe. Abounds in the Alps and Pyrenees.

DESCRIPTION.—The *rhizome* or *cormus* (*radix veratri*, offic., *radix hellebori albi*) is single-, double-, or many-headed, having the form of a cylinder, or, more frequently, of a truncated cone. It is from two to four inches long, and about one inch in diameter, rough, wrinkled, grayish, or blackish-brown externally, whitish internally. Portions of the root fibres are usually attached to it, as well as some soft, fine hair-like fibres. At the upper extremity of the rhizome we frequently observe the cut edges of numerous concentric, woody, or membranous scales: they are portions of the dried leaf-sheaths. When cut transversely, the rhizome presents a large central portion (frequently called *medulla*), which varies in its qualities; being woody, farinaceous, or spongy, in different specimens. This is separated by a brown fine undulating line from a thick woody ring, in which the root fibres take their origin. On the outside of this is a narrow but compact brown epidermoid coat. The odour of the dried rhizome is feeble; the taste is at first bitter, then acrid. By keeping, the rhizome is apt to become mouldy.

The rhizome of *Veratrum viride* is used in the United States as a substitute for that of *Veratrum album* (see p. 186).

COMPOSITION.—White hellebore rhizome was analyzed in 1820 by MM. Pelletier and Caventou,¹ who obtained the following results: *Fatty matter* (composed of *olein*, *stearin*, and a *volatile* [cevadie?] *acid*), *supergallate of veratria*, *yellow colouring matter*, *starch*, *liguaceous matter*, and *gum*. The ashes contained much *phosphate* and *carbonate of lime*, *carbonate of potash*, and some traces of *silica* and *sulphate of lime*, but no chlorides. They could not obtain the volatile [cevadie?] acid in a crystalline form.

1. VERATRIA. (See p. 180).

2. JERYIN (so called from *Jerva*, the Spanish name for a poison obtained from the root of white hellebore);² *Barytin*.—A white crystalline, fusible, and inflammable substance, discovered

Fig. 219.



Veratrum album, Linn. var. *albiflorum*.

¹ *Journ. de Pharm.* vol. vi. p. 363.

² *Bauhin's Pinax*, p. 186.

by Simon.¹ It is soluble in alcohol, but not in water. With acetic and phosphoric acids it yields readily soluble salts; but, on the contrary, with sulphuric, nitric, and hydrochloric acids, it forms difficultly soluble compounds.² On account of its resembling baryta in being precipitable from its solution in acetic acid by sulphuric acid, it was called at first *barytin*. Its composition, according to Will, is $C^{60}H^{46}N^{20}O^5$.

CHEMICAL CHARACTERISTICS.—A decoction of the rhizome undergoes, on the addition of a solution of gelatin, no change, showing the absence of tannic acid; but with the sesquichloride of iron, it becomes olive green (*gallate? of iron*). With tincture of galls, it became slightly turbid (*tannates of veratria and starch*). With acetate and diacetate of lead, and protonitrate of mercury, it formed copious precipitates. Oil of vitriol reddens the concentrated decoction, owing to its action on the veratria. The rhizome left after the decoction had been prepared from it, becomes, on the addition of a solution of iodine, black (*iodide of starch*).

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Not ascertained.

β. On Animals generally.—"The best account of its effects is contained in a thesis by Dr. Schabel, published at Tübingen, in 1817. Collecting together the experiments previously made by Wepfer, Courten, Viborg, and Orfila, and adding a number of excellent experiments of his own, he infers that it is poisonous to animals of all classes—horses, dogs, cats, rabbits, jackdaws, starlings, frogs, snails, and flies; that it acts in whatever way it is introduced into the system—by the stomach, windpipe, nostrils, pleural membrane of the chest, on external wounds, or the veins; that it produces in every instance symptoms of irritation in the alimentary canal, and injury of the nervous system; and that it is very active, three grains of the extract applied to the nostrils of a cat having killed it in sixteen hours."³

γ. On Man.—Its local action is that of a powerful acrid. Applied to the Schneiderian membrane, it excites violent sneezing. Epistaxis even is said to have been induced by it. Its operation, when swallowed or placed in contact with the skin, is also that of an energetic irritant.

Its remote action is on the secretory apparatus, the stomach and intestines, and the nervous system. In *small and repeated doses*, it promotes secretion from the mucous surfaces, the salivary glands, the kidneys, and the uterus, and increases the cutaneous exhalation.⁴ In *larger doses*, it causes vomiting, purging, pain in the abdomen, tenesmus, and occasionally bloody evacuations, and great prostration of strength. In some instances, a few grains even have had these effects. Schabel says there is no substance which so certainly and promptly provokes vomiting; and Horn⁵ employed it as a sure emetic. In addition to the local action which it exercises, when swallowed, on the stomach and intestines, it possesses a specific power of influencing these viscera: for Etmüller⁶ has seen violent vomiting result from the application of the rhizome to the abdomen; and Schröder⁷ observed the same occurrence where the rhizome was used as a suppository. In *excessive doses*, it operates as a narcotico-acrid poison, producing gastro-intestinal inflammation and an affection of the nervous system. The symptoms are violent vomiting and purging (sometimes of blood), tenesmus, burning sensation of the mouth, throat, œsophagus, stomach, and intestines, constriction of the throat, with a sense of strangulation, gripping pain in the bowels, small, and, in some cases, almost imperceptible pulse, faintness, cold sweats, tremblings, giddiness, blindness, dilated pupils, loss of voice, convulsions, and insensibility, terminating in death. A cutaneous eruption has, in some instances, followed the use of white hellebore.

I am indebted to Dr. Wm. Rayner, of Stockport, for notes of three cases of poisoning by infusion of white hellebore. The symptoms resembled those just mentioned, except that there was no purging. All three cases rapidly recovered.

¹ Poggendorff's *Annalen*, xli. 569; and *Pharmaceutisches Central Blatt für 1837*, S. 191.

² *Pharm. Central Blatt für 1837*, S. 753; also, *Berlinisches Jahrb. für d. Pharm.* Bd. xxxiii. S. 363; and *Lond. and Edinb. Phil. Mag.* vol. xii. p. 29.

³ Christison's *Treatise on Poisons*, 3d edit. p. 790.

⁴ *Archiv. R. x. H. 1*, S. 161.

⁵ Orfila, *Toxicol. Gén.*

⁶ *Greding Samml. med. Schrift.* Th. 1, S. 179.

⁷ *Opera omnia*, tom. ii. pt. ii. p. 144.

Hutchinson¹ remarked that, when death did not occur, palpitation and intermitting pulse, besides dyspeptic and nervous symptoms, remained for some time.

These effects were not observed in Dr. Rayner's cases.

In its action on the system, *Veratrum album* is more closely related to *cebadilla* and meadow saffron than to any other medicinal agents. It is more acrid and less stupefying than *Helleborus niger*, with which it has been so frequently compared both by ancients and moderns. Orfila² ascertained, by experiment on animals, that it is more active as a poison than the last-mentioned substance. It exercises no known chemical influence over the tissues by which it is distinguished from the mineral irritants, as baryta and emetic tartar, with which Schabel compared it.

USES.—It is but rarely employed, principally on account of the alleged uncertainty of its operation. But, from the few trials which I have made with it, I suspect this uncertainty is much exaggerated, and is principally referable to the varying lengths of time which the rhizome has been kept after its removal from the earth, for, like *colchicum*, it deteriorates by keeping. The following are the principal cases in which it has been employed:—

1. *In affections of the nervous system*, as melancholia, mania, and epilepsy.³ As an emetic, purgative, and promoter of the secretions generally, we can easily understand that it may prove occasionally beneficial.

2. *In chronic skin diseases*, as herpes, Dr. C. Smyth⁴ gave the tincture internally with benefit. As external applications, the decoction and ointment are used in scabies (hence the Germans call the rhizome *Kratzwurzel*, i. e. *itch-root*), *tinea capitis*, &c.; but their use is not quite free from danger.

3. *In gout*, it was given in combination with opium, by Mr. Moore,⁵ as a substitute for, or in imitation of, the *Eau Médicinale*. The dose, in a paroxysm of gout, was from forty minims to two drachms of a mixture composed of three parts of *Vin. Veratri albi* and one part of liquid laudanum.

4. *In amaurosis and chronic affections of the brain* occurring in torpid habits, it is employed as an errhine or sternutatory (hence its German name, *Niesswurzel*, i. e. *sneeze-root*). It is usually diluted with some mild powder. The German snuff called *Schneeberger* is said to contain it.

5. *To destroy pediculi*, the decoction is used as a wash.

6. *As an emetic*, it was employed by Horn.

ADMINISTRATION.—The following are the principal modes of exhibition:—

1. **PULVIS VERATRI**; *White Hellebore Powder*.—The dose of this at the commencement should not exceed one or two grains. This quantity will sometimes occasion nausea and vomiting; but Greding found that in some cases eight grains, and, in a few instances, a scruple of the bark of the rhizome in powder were required to excite vomiting. As an errhine, not more than two or three grains, mixed with eight or ten of some mild powder (as starch, liquorice, Florentine orris, or lavender) should be employed at one time. It is a constituent of the *Unguentum Sulphuris compositum* (see vol. i. p. 360).

2. **VINUM VERATRI, L.**; *Tinctura Veratri albi*; *Tincture of White Hellebore*.—(White Hellebore, sliced, ℥viij; Sherry Wine Oij. Macerate for seven days, and strain.)—As a substitute for *colchicum* in gout and rheumatism, the dose is ten minims twice or thrice daily. This quantity is to be gradually increased. A full dose acts as an emetic and cathartic.

3. **DECOCTUM VERATRI, Ph. L. 1836**; *Decoction of White Hellebore*.—(White Hellebore, bruised, 3x; Distilled Water Oij; Rectified Spirit fʒiij. Boil the hellebore in the water down to a pint, and when it is cooled, add the spirit.)—This preparation is only used as an external application in skin diseases (scabies, lepra,

¹ Schwartz's *Pharm. Tab.* 2te Ausg.

² Greding, *Sammtl. mediz. Schriften*. T. 1, S. 179.

³ Two Letters to Dr. Jones, 1811.

⁴ *Toxicol. Gén.*

⁵ *Med. Communications*, vol. i. p. 207.

tinea capitis, &c.), and to destroy pediculi. When the skin is very irritable, the decoction will sometimes require dilution. If the surface to which it is applied be denuded, absorption of the veratria may occur, and constitutional symptoms be thereby induced; hence it is a dangerous application, especially to children.

4. *UNGUENTUM VERATRI*, Ph. L. 1836 [*Unguentum Veratri albi*, U. S.]; *Ointment of White Hellebore*.—(White Hellebore, powdered, ℥ij; Lard ℥vii; Oil of Lemons ℥xx. Mix.)—This ointment is used in the treatment of the itch as a substitute for the disagreeable, though far more effective, sulphur ointment. Like the decoction, there is danger of the absorption of the active principle of the rhizome when the ointment is applied to raw surfaces; it is, therefore, an unfit remedy for children.

ANTIDOTES.—Astringent solutions have been recommended; and in one case, which fell under my notice, infusion of nutgalls seemed to give relief. The supposed benefit has been referred to the union of tannic acid with veratria, by which the solubility and activity of the latter are diminished; but Schabel¹ found that three drachms of a tincture of white hellebore, given with infusion of galls, to a cat, proved fatal in twenty minutes. Hahnemann recommends coffee, both as a drink and in elyster. Demulcent liquids, and, in some cases, opiates, may be useful. The other parts of the treatment must be conducted on general principles. Stimulants will be usually required on account of the failure of the heart's action.

58. *Veratrum viride*, Willd.—American Hellebore.

Sex. Syst. Polygamia, Monœcia.

(Rhizoma)

[The *VERATRUM VIRIDE*, U. S. (*Secondary List*), is known in the United States as *American Hellebore*, *Swamp Hellebore*, *Indian Poke*, and *Itch Weed*. It has a perennial, thick, fleshy root, terminated at top, the lower part solid and sending off numerous white or light yellow radicles. The stem is annual, from two to three feet high, pubescent. Leaves at base six inches to a foot long, broad, oval, nerved, acuminate, of a deep green colour, and pubescent; those on the stem narrower, and, at the summit, bracteeform. Flowers in panicles, terminal, and of a greenish-yellow tint. The calyx is wanting; petals six, stamens six, pistil a rudiment (*Willd. now*). Germs three, when not rudimentary, on the lower portion of the panicle.

The plant is found in many parts of the United States, from Canada to Carolina, inhabiting damp places in the neighbourhood of streams and meadows. It appears early in March.

The whole plant has an acrid and burning taste; the root only is officinal. This, when dried consists of a somewhat tubercled top, with a thick hard base, and numerous radicles attached to it. The odour, disagreeable in the recent state, is lost by drying. The taste is at first sweetish, then bitter, followed by an acrid burning sensation in the mouth, which lasts for some hours after it has been chewed. When powdered, it acts as a sternutatory. For the composition of this root, we are indebted to Mr. Henry Worthington (*American Journal of Pharmacy*, vol. x. p. 97), who found it to contain *gum, starch, sugar, bitter extractive, fixed oily matter, colouring matter, gallic acid, an ALKALOID substance identical with veratria, lignin, and salts of lime, and potassa*. With regard to the alkaloid substance, he describes it as "nearly insoluble in water, more soluble in ether, and entirely soluble in absolute alcohol. When exposed to flame, it first melts, then swells up, and burns without residue. It produces a burning acrid sensation in the mouth, which lasts for several hours. It acts powerfully as a sternutatory, producing violent sneezing, which lasts for half an hour after it has been applied to the nose." "In its chemical relations, the analogy is carried out by not being changed to a red colour by the action of nitric acid, and from its forming salts with the acids, none of which are crystallizable but the sulphate, tartrate and oxalate."

That the framers of the United States Pharmacopœia have done well in the introduction of this article, is shown by the testimony in its favour as a potent medicine. Dr. Osgood (*Am. Journ. of Pharm.*, vol. vii. p. 212), and Dr. Ware (*Bigelow's Med. Bot.* vol. ii. pp. 127, 132), have each instituted a course of experiments to test its remedial powers. The first found it an emetic; and the second met with a case where this effect on the stomach was produced by the application of the ointment to an ulcer on the leg. Mr. Worthington submitted himself to the test of its powers. He took the fourth of a grain of the *Alcoholic Extract*, which caused an acrid burning sensation in the mouth, and communicated to the throat and fauces a sense of dryness and heat, which finally reached the stomach. In the course of about an hour, this dryness at

¹ Quoted in Brandt and Ratzburg's *Giftgewächse*, Abt. 1, S. 28.

burning sensation in the throat and stomach became intense, and a disposition to hiccough was excited, which soon commenced, gradually increasing in frequency until it reached fifteen or twenty times per minute. This was attended with some sickness and retching until vomiting took place. This was violent, and seemed to come on about every ten or fifteen minutes for the space of an hour. During this time, dizziness and tremor were created, which passed off with the effect of the dose. With the hiccough there was a copious secretion of saliva and discharge of mucus from the stomach and nose. During the action of this dose, the pulse was weakened so as to be scarcely perceptible, and reduced from sixty-eight to fifty-two pulsations per minute. (*Op. cit.*)

The experiment just detailed was repeated three times, and in neither was there a disposition to catharsis. The effects are those of an acro-narcotic, and not one of the least potent of this class of remedies. The uses and mode of administration are similar to those of the White Hellebore. In gout and rheumatism, the medical gentlemen before mentioned speak in its favour. A knowledge of it is stated to be possessed by the North American Indians.—J. C.]

59. *Veratrum Sabadilla*, Retz.

Sex. Syst. Polygamia, Monœcia.

(Semina.)

A native of Mexico and the Antilles. Its leaves are radical, oval-oblong, obtuse, ribbed. Its stem is almost leafless. The panicle is nearly simple. The flowers have short pedicels, and are nodding.

Its fruit and seeds are said to be brought from the Antilles, under the name of *cebadilla* (*semina sabadillæ caribææ*), but I have never met with them.

60. ASAGRÆA OFFICINALIS, Lind.—SPIKE-FLOWERED ASAGRÆA.

Sex. Syst. Hexandria, Trigynia.

(Alkali e semine comparatum, L.—*Sabadilla*; Fruit of *Veratrum Sabadilla*¹ of *Helonias officinalis*, and probably of other *Melanthaceæ*, E.)

SYNONYMES.—*Veratrum officinale*, *Schlecht*; *Helonias officinalis*, *Don*.

HISTORY.—This plant was described by Schlechtendahl,² afterwards by Mr. Don,³ and subsequently by Dr. Lindley.⁴ The seeds were known to Menardes in 1573. They were called *sabadilla*, or *cevadilla*, or, more properly, *cebadilla* (from the Spanish *cebada*, *barley*), on account of the supposed resemblance of the inflorescence of the plant to that of *hordeum*.

BOTANY. *Gen. Char.*—*Flowers* polygamous, racemose, naked. *Perianth* six-partite; *segments* linear, veinless, almost equal, with a nectariferous excavation at the base, equal to the stamens. *Stamens* alternately shorter; *anthers* cordate, as if unilocular, after dehiscence shield-shaped. *Ovaries* three, quite simple, attenuated into an obscure stigma. *Follicles* three, acuminate, papery; *seeds* scimitar-shaped, corrugated, winged. *Bulbous herbs*, with grass-like leaves, and small, pale, densely-racemed flowers. (*Lindley*.)

Sp. Char.—The only species known.

Leaves linear, acuminate, subcarinate, roughish at the margin, four feet long, and three lines broad. *Scape* round, about six feet high. *Raceme*, a foot and a half long, very dense, very straight, spiciform. *Flowers* white, with a bractea at the base. *Anthers* yellow.

Hab.—Eastern side of the Mexican Andes, near Barranca de Tioselo (*Schiede*). Neighbourhood of Vera Cruz (*Hartweg*).

DESCRIPTION.—The *cebadilla*, *cevadilla*, or *sabadilla* of the shops (*sabadilla*; *semina sabadillæ mexicanæ*), comes from Vera Cruz and Mexico. It consists of the follicles (some containing seeds, others empty), loose seeds, stalks,

Fig. 220.



Asagræa officinalis.

- a. Fruit-bearing stem.
b. Root, bulb, and leaves.

¹ See p. 185.

² *Ed. New Phil. Journ.* Oct. 1839.

³ *Linnea*, vi. 45.

⁴ *Bot. Reg.* June, 1839.

and abortive flowers of the *Asagraea officinalis*, and perhaps of *Veratrum Sabadilla* also.

The follicles, commonly termed capsules, rarely exceed, or even equal, half an inch in length, and are about one line or a line and a half in diameter. They are ovate-oblong, acuminate. Their colour is pale yellowish-brown, or reddish-gray. The coat of each is thin, dry, and of a papery consistence. Each fruit is composed of three follicles mutually adherent towards the base, open at the superior and internal part. The receptacle, fruitstalk, and the remains of the dried and withered calyx, are usually present in the cebadilla of the shops. Seldom more than one or two, though sometimes three, seeds are found in each follicle.

The seeds are two or three lines long, scimitar-shaped, pointed, blackish-brown, shiny, wrinkled or corrugated, slightly winged. Internally, they are whitish or horny. Embryo straight, next the hilum, lodged in fleshy albumen. They have little odour, but a bitter, acrid, persistent taste.

COMPOSITION.—Two analyses of cebadilla have been made about the same time (1819); one by Meissner;¹ and a second by Pelletier and Caventou.² The following are the results:—

MEISSNER'S ANALYSIS.		PELLETIER AND CAVENTOU'S ANALYSIS.	
Fatty matter (<i>olein</i> and <i>stearin</i>)	24.63	Fatty matter composed of	$\left\{ \begin{array}{l} \text{Olein.} \\ \text{Stearin.} \\ \text{Cevadic acid.} \end{array} \right.$
Wax (<i>myricin</i>)	0.10	Wax.	
Sabadillin (<i>veratria</i>)	0.58	Supergallate of <i>veratria</i> .	
Resin (soluble in ether)	1.45	Yellow colouring matter.	
Hard resin (insoluble in ether)	8.45	Starch.	
Bitter extractive with the acid which is united } to the sabadillin	5.97	Lignin.	
Sweet extractive	0.65	Gum.	
Extractive separable by alkalis	24.14		
Gum	4.90		$\left\{ \begin{array}{l} \text{Carbonate of potash.} \\ \text{lime.} \\ \text{Phosphate lime.} \\ \text{Chloride potassium.} \\ \text{Silica.} \end{array} \right.$
Vegetable jelly (<i>phyteumacolla</i>) with chloride of potassium and vegetable salts of } potash	1.11	Ashes composed of	
Oxalate of lime combined with bassorin . . .	1.06		
Lignin	20.56		
Water	6.10		
Cebadilla	100.00	Cebadilla.	
The ashes contained oxide of copper.			

1. **CEYADIC OR SABADILLIC ACID.**—This is a crystalline, fusible, volatile, fatty acid, having an odour analogous to butyric acid. It is soluble in water, alcohol, and ether. It is obtained by the saponification of the oil of *cebadilla* (fatty matter). Cevadate of ammonia causes a white precipitate with the persalts of iron. The composition of this acid is unknown.

Oil of *cebadilla* given me by Mr. Morson is green, lighter than water, and has a faint, somewhat rancid taste.

2. **VERATRIC ACID**, of Merck.³—This is a crystalline, fusible, volatile acid, soluble in alcohol, slightly so in water, but insoluble in ether. According to Schroetter, it consists of $C^{14}H^{10}O_7 + aq$.

3. **RESINS.**—The two resins found by Meissner, but overlooked by Pelletier and Caventou, are probably endowed with activity.

Conerbe obtained from cebadilla seeds, *sabadillina*, *helonin* or *resin of veratria*, and *gum resin of sabadillina*.

a. *Sabadillina* is a white crystalline solid, possessing alkaline properties, being soluble in boiling water and in alcohol, but not in ether. In the fused state it consists of $C^{20}H^{16}NO^3$. It forms with acids crystallizable salts. It is said, by Simon,⁴ to be merely a compound of resinate of soda and resinate of *veratria*. Dr. Turnbull found it inferior in activity to *veratria*.

β. *Helonin* or *resin of veratria* (*veratrin*, Conerbe; *pseudo-veratria*) is a brown solid, fusible at 365°. Insoluble in ether (by which it is distinguished from *veratria*), and in water. It combines with acids; but neither saturates them, nor forms with them any crystallizable salts. It consists of $C^{14}H^8NO^3$. Its action on the animal economy has not been determined.

γ. *Gum-resin of sabadillina* (*resinagomme*, Conerbe; *monohydrate of sabadillina*, Alter.) is a reddish solid, soluble in water and alcohol, but slightly so in ether. It saturates acids, but does not form crystalline compounds with them. Alkalies throw it down from its saline combinations. It consists of $C^{20}H^{14}NO^6$. Hence it differs from anhydrous *sabadillina* in containing an atom more water. Furthermore, it is distinguished from this alkali in not being crystallizable.

4. **VERATRIA.**—(See p. 190.)

¹ Schweigger's Journ. f. Chem. xxxi. 187.

² Pharmaceutisches Central-Blatt für 1839, S. 235.

³ Journ. de Pharm. vi. 353.

⁴ Berl. Jahrb. Bd. xxxix. S. 393.

CHEMICAL CHARACTERISTICS.—The brownish-coloured decoction of cebadilla reddens litmus, owing to the presence of free acid. Sesquichloride of iron deepens the colour of the decoction, and causes an olive brown precipitate. Alkalies deepen, whilst acids diminish, the colour of the decoction (by their action on the yellow colouring matter, *Pelletier*). Acetate and diacetate of lead, protonitrate of mercury, and sulphate of copper, form precipitates in the decoction. Oxalate of ammonia renders it turbid (*oxalate of lime*). Nitrate of silver forms a coloured precipitate, which is, for the most part, soluble in nitric acid: the insoluble portion is *chloride of silver*. Solutions of iodine and tincture of nutgalls have no obvious effect. Oil of vitriol reddens the decoction owing to its action on the veratria.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Not ascertained.

β. On Animals.—Are similar to those of *Veratrum album*. Cebadilla has proved poisonous to dogs and cats.¹ A pinch of it produced violent spasms in cats; half a drachm caused vomiting and convulsions in dogs. It is a poison to insects. Thus bugs die from it in convulsions: hence its use as a bug poison.² Its efficacy in destroying pediculi has long been known.

γ. On Man.—The action is probably similar to, though more acrid than, white hellebore. The effects of *small and repeated doses* have not been satisfactorily ascertained. *Large and poisonous doses* cause burning and pain in the throat and stomach, nausea, vomiting, purging, prostration of strength, convulsions, delirium, and sometimes a cutaneous eruption. Even the external application of the powder has caused dangerous effects. Plenck tells us of a young man who was rendered temporarily insane by the application of powder of cebadilla to the head. Lentin says an infant, whose nurse had sprinkled the powder in its hair, died in convulsions.³

Rubbed on the skin, the tincture causes a stinging sensation similar to that produced by veratria. After its use for some days, a slight eruption appears on the skin. Rubbed over the cardiac region, it in some instances reduces the frequency and force of the pulse in a marked degree. The alcoholic extract has nearly the same effects, when taken internally, as veratria. It also induces sensations of heat and tingling on the surface of the skin, and sometimes acts as a diuretic.⁴

USES.—Cebadilla has been employed internally, as an *anthelmintic*, in both thread-worms and tape-worms.⁵ Dr. Turnbull⁶ has given the extract with benefit in painful rheumatic and neuralgic affections. Though it is applicable in all the maladies for the relief of which veratria has been recommended, it is rarely administered by the mouth.

Externally the powder of the seeds has been used to destroy pediculi; hence the Germans called the seeds *Läuse-saamen*, or *lice-seeds*. But it cannot be applied with safety to children, and especially when the skin is broken. I have already referred to the dangerous consequences of its employment. The tincture has been used as a rubefacient in chronic rheumatism, and, rubbed over the heart, in some cases of nervous palpitation.⁷ It may, in fact, be employed as a cheap though efficient substitute for the tincture of veratria.

But the principal use of the seeds, for which indeed they have been introduced into the Pharmacopœia, is for yielding veratria.

ADMINISTRATION.—The following are the preparations of cebadilla which have been employed in medicine.

I. PULVIS SABADILLE; *Pulvis contra pediculos; Poudre de Cupucin; Powder of Cebadilla.*—The dose for an adult is from two to six grains; gradually increased. In one case of tape-worm, half a drachm was taken daily for fourteen days.⁸

¹ Willemet, *Nouv. Mém. de l'Acad. de Dijon*, 1782.

² Seeliger, in Schmucker's *Vermischt. chirurg. Schrift.* vol. ii. p. 272.

³ Murray, *App. Med.* vol. v. p. 172.

⁴ Turnbull, *On the Medicinal Properties of the Ranunculaceæ*, p. 7.

⁵ Schmucker's *Verm. chirurg. Schrift.* Bd. ii. S. 271.

⁶ Turnbull, *op. cit.*

⁷ *Op. cit.* p. 7.

⁸ Seeliger, in Schmucker, *op. cit.* vol. ii. p. 271.

2. **TINCTURA SABADILLE**; *Saturated Tincture of Cebadilla*, Turnbull.—(Cebadilla seeds, freed from their capsules and bruised, *any quantity*; Rectified Spirit, *as much as will cover them*. Digest for ten days.)—Used as a rubefacient liniment in chronic rheumatism and paralysis. It is rubbed over the heart in nervous palpitation.

3. **EXTRACTUM ALCOHOLICUM SABADILLE**; *Alcoholic Extract of Cebadilla*.—Evaporate the saturated tincture, with a very gentle heat, to a proper consistence. Dose, 1-6th of a grain, gradually increased. It is given, in the form of pill, in rheumatic and neuralgic cases.

4. **VERATRIA**, L. E. [U.S.]; *Veratrin*; *Veratrina*, Thomson; *Sabadillin*, Meissner.—This vegetable alkaloid was discovered about the same time (1819), by Meissner in Germany, and by Pelletier and Caventou in France. Couerbe¹ probably was the first who obtained it pure.

The process of the Edinburgh Pharmacopœia is as follows:—

“Take any convenient quantity of Cevadilla: pour boiling water over it in a covered vessel, and let it macerate for 24 hours; remove the Cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel. Grind the seeds in a coffee-mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be coloured. Concentrate the spirituous solutions, by distillations, so long as no deposit forms, and pour the residuum, while hot, into twelve times its volume of cold water. Filter through calico, and wash the residuum on the filter so long as the washings precipitate with ammonia. Unite the filtered liquid with the washings, and add an excess of ammonia. Collect the precipitate on a filter, wash it slightly with cold water, and dry it, first by imbibition with filtering paper, and then in the vapour bath. A small additional quantity may be got by concentrating the filtered ammoniacal fluid, and allowing it to cool.

“Veratria thus obtained is not pure, but sufficiently so for medicinal use. From this coloured substance it may be obtained white, though at considerable loss, by solution in very weak muriatic acid, decolorization with animal charcoal, and re-precipitation with ammonia.”

Cebadilla yields, to rectified spirit, veratria in combination with a vegetable acid. Ammonia unites with the vegetable acid, and sets free the alkaloid.

By Couerbe's process, a drachm of commercial veratria may, it is said, be procured from one pound of cebadilla.

Commercial veratria was said by Couerbe to be composed of *pure veratria*, *sabadillina*, *resin of veratria* (veratrin, Couerbe), and *gum-resin of veratria* (resin-gomme, Couerbe). These are separated from each other by the successive action of water, ether, and alcohol, as shown by the following table:—

Commercial Veratria	{ yields to boiling water . .	1. <i>Sabadillina</i> , which crystallizes on cooling.
		2. <i>Resin of Veratria</i> , left in the cold solution.
	{ insoluble in boiling water	3. <i>Veratria</i> , soluble in ether.
		4. <i>Gum-resin of veratria</i> , insoluble in ether, but soluble in alcohol.

The nature of *sabadillina* has been already pointed out (p. 188).

PROPERTIES.—*Commercial veratria* is pulverulent, odourless, and grayish or brownish white. All the samples I have tasted were bitter and acrid, and produced a feeling of numbness and tingling when applied to the tongue. But *pure veratria* is an almost white, friable solid, having the aspect of a resin: it is uncrystallizable, odourless, has a very acrid taste, without any mixture of bitterness. It is fusible at 240° F. It is sparingly soluble in ether, readily so in alcohol, scarcely so in cold water. It possesses alkaline properties: thus, it restores the blue colour of reddened litmus, and saturates acids. Its salts crystallize with difficulty: indeed, the *sulphate* and *hydrochlorate* alone have been obtained in the state of crystals; the other salts have a gummy aspect. Both the hydrochlorate and sulphate are soluble in water.

Characteristics.—Veratria is known by the following characters: Its alkalinity, its combustibility, its uncrystallizability, the difficult crystallizability of its salts, its solidity at ordinary temperatures, its ready solubility in alcohol, its being almost

¹ *Ann. de Chim. et de Phys.* t. 52, p. 368.

insoluble in water, and by the intense red colour which it assumes when mixed with oil of vitriol. Pure veratria is readily soluble in ether; not so, impure or commercial veratria. Nitric acid renders commercial veratria reddish, and forms a yellow solution with it (see *Morphia and Narcotina*). A solution of veratria in dilute acetic acid produces a whitish precipitate (*tannate of veratria*) with tincture of nutgalls, a white one (*hydrated veratria*) with ammonia, and an intense red colour with oil of vitriol. Carbazotic acid does not occasion a precipitate unless the solution be concentrated. To these chemical peculiarities must be added those characteristics derived from its physiological effects: A minute portion of veratria causes violent sneezing, and a small quantity of a solution of four grains of veratria in a fluidrachm of rectified spirit, rubbed on the wrist or forehead, produces, within three or four minutes, heat and tingling. Pure veratria is less apt to occasion sneezing, by handling, than the impure or commercial sort.

The *London College* (1851) gives the following characters of veratria: Dissolves but slightly in water, more soluble in ether, but most in alcohol. It has no smell, but violently irritates the nostrils, and has a bitter taste. It is to be cautiously administered.

[The following characteristics are given by the *U. S. Pharm.* Pulverulent, grayish-white, inodorous, but very irritant to the nostrils, and of an acrid bitter taste, causing a sensation of tingling with numbness in the tongue. It is very slightly soluble in water, but readily and wholly dissolved by alcohol. It has an alkaline reaction, and is entirely dissipated by a red heat. With nitric acid it forms a yellow solution, and, when in contact with concentrated sulphuric acid, becomes intensely red.]

COMPOSITION.—The following is the composition of pure veratria, according to Couerbe:—

	Atoms.	Eq. Wt.	Per Cent.	Couerbe.
Carbon	34	204	70.83	70.786
Hydrogen	22	22	7.64	7.636
Nitrogen	1	14	4.86	5.210
Oxygen	6	48	16.67	16.363
Veratria	1	288	100.00	100.000

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—Magendie¹ has shown that the local action of veratria is that of an irritant. Placed in the nostrils of a dog, the acetate of veratria provoked violent and continued sneezing. When introduced into the intestinal canal, it caused inflammation. Applied to parts whence absorption goes on actively (as the pleura and tunica vaginalis), it occasions tetanus, and death in a few minutes. Foreke² gave moderate and gradually increased doses ($\frac{1}{8}$ to $\frac{1}{4}$ of a grain) of veratria for twenty days. It caused vomiting, and occasionally foaming at the mouth. The stools continued hard. Dr. Bardsley³ observed vomiting and giddiness (reeling) produced in animals to whom he gave veratria.

β. On Man.—Applied to the nose, a minute quantity excites excessive sneezing. Rubbed on the skin in the form of ointment, it causes a sensation of heat and tingling (called by Dr. Turnbull *electro-stimulation*). This effect is not confined to the part and its immediate neighbourhood where the application has been made; for somewhat similar sensations are occasionally experienced in distant parts.

Taken internally, in *small or medicinal doses*, veratria excites a feeling of warmth in the stomach and bowels, which extends to the chest and extremities. Tingling and various anomalous sensations (as of a current of hot or cold air or water passing over the skin) are perceived in various parts of the body. Nausea and vomiting are occasionally excited by a full dose. On the secretions and exhalations its action is not very uniform. It frequently produces perspiration, and not unfrequently diuresis. Foreke⁴ mentions increased secretion of saliva and of tears produced without the contact of the veratria either with the conjunctiva or mouth. The bowels are for the most part confined, so that purgatives are not unfrequently required during the use of it. Yet in some cases veratria has caused copious bilious evacuations. In

¹ *Formulaire*, p. 162, 8me edit.
² *Hosp. Facts and Observ.* 1829.

² *Untersuch. über d. Veratrin*, 1837.
⁴ *Op. cit.* p. 22.

some instances it has promoted, in others diminished, the appetite. Foreke mentions that a pustular eruption is sometimes induced by it. Dr. Bardsley generally found the pulse become slower and depressed after the use of veratria.

I am not acquainted with any cases of poisoning in the human subject by *excessive doses* of veratria. Vomiting and convulsions would probably be induced.

USES.—Veratria is employed externally or internally: sometimes in both ways at the same time. It has been tried in the following cases:—

a. *In neuralgia*, it has been used by Dr. Turnbull, Dr. Ebers of Breslau,¹ and Dr. Foreke. It is applied in the form of ointment, containing from twenty to forty grains of veratria to an ounce of lard. The frictions are to be continued until the heat and tingling caused by the veratria have acquired a considerable degree of intensity. Though, according to my own experience, it fails to give relief in a large majority of cases, yet in some few its effects are highly beneficial, and in none is it injurious. As a remedy for neuralgia, it is, however, far inferior to *Aconitum* and its alkali *Aconitina*.

β. *In some nervous diseases* (Neuroses, Cull.)—Veratria has been extensively used in this class of diseases, but for the most part empirically. If it possess any therapeutical power, “a more extended experience is required to establish its claim to our regard.”² Among the maladies against which it has been used (in some instances internally, but mostly externally) are—nervous palpitation, paralysis, hooping-cough, epilepsy, hysteria, hypochondriasis, &c.³

γ. *In rheumatism and gout*.—Dr. Bardsley gave it internally in rheumatism, but with no remarkable results. Externally it has been employed in the form of ointment by Sir C. Scudamore and Dr. Turnbull. It should not be applied while the inflammation is of an active kind. It would appear to be best adapted for the neuralgic forms of rheumatism.

δ. *In dropsy*.—Dr. Bardsley administered it internally in dropsy, but says it possesses “no particular claims to the attention of the profession.” Ebers employed veratria endermically, and also in the form of ointment, epidermically. It acted as a diuretic, and gave relief.⁴

ADMINISTRATION.—The ordinary veratria of the shops is administered in doses of one-sixth of a grain, three times a day. On account of its acidity it should not be given in solution, but in the form of pills.

a. *Pilule Veratriæ; Veratria Pills*; Turnbull.—Veratria gr. j; Extract of Hyoscyamus: Liqueur powder, aa. gr. xij. Let 12 pills be made, of which one may be taken every three hours.

β. *Tinctura Veratriæ; Veratria Embrocation*; Turnbull.—Veratria ℥j.; Rectified Spirit ℥ij. Dissolve. This embrocation is sometimes used as a substitute for the ointment. Magendie (*Formulaire*) directs a tincture of veratria to be prepared by dissolving four grains of the alkali in an ounce of alcohol. Of this from 10 to 25 drops are taken, in a cup of broth, as a substitute for the tincture of colchicum.

γ. *Unguentum Veratriæ; Veratria Ointment*; Turnbull.—Veratria ℥ss.; Olive Oil ℥j; Prepared Lard ℥j. M.

δ. *Sales Veratriæ*.—The sulphate and tartrate of veratria (prepared by saturating veratria with sulphuric or tartaric acid) are sometimes used instead of the uncombined alkali. The dose and mode of administration are the same as for the latter.

ANTIDOTE.—*Vide VERATRUM ALBUM.*

ORDER XI. LILIACEÆ, Lindl.—LILYWORTS.

CHARACTERS.—*Calyx* and *corolla* both alike, coloured, regular, occasionally cohering in a tube. *Stamens* six, inserted into the sepals and petals; *anthers* opening inwards. *Ovary* superior, three-celled, many seeded; *style* one; *stigma* simple or three-lobed. *Fruit* succulent, or dry and capsular, three celled. *Seeds* packed one upon another in one or two rows; *embryo* with the

¹ Dierbach, *Neuest. Entd. in d. Mat. Med.* 1837.

² Paris, *Appendix to the 8th edit. of the Pharmacologia.*

³ See the treatises of Turnbull and Foreke, before referred to.

⁴ See Foreke, *op. supra cit.*

same direction as the seed, in the axis of fleshy *albumen*, or uncertain in direction and position, occasionally very minute. *Herbaceous* plants, shrubs, or trees, with bulbs, or tubers, or rhizomes, or fibrous roots. *Leaves* narrow, with parallel veins, membranous, not articulated with the stem; either sessile or with a narrow leafy petiole.

PROPERTIES.—Not uniform. Mucilage, resinous matters, acrid volatile oils, and acrid extractive substances, are the organic principles to which the medicinal qualities of this order are chiefly referable. Their relative proportions, however, vary considerably in different species.

The fleshy bulbs are usually more or less acrid. Those of the genus *Allium* owe their acridity to a volatile oil (*sulphuret of allyle*) whose composition is C^6H^5S (see vol. i. p. 253). Bundles of acicular crystals or *raphides*, usually considered to be phosphate, but by Schleiden declared to be oxalate, of lime are found in some of the cells of these bulbs.

61. ALOË, Linn.—ALOE.

Sex. Syst. Hexandria, Monogynia.

(*Succus proprius spissatus foliorum ex variis Aloës speciebus.*)

HISTORY.—Neither aloe plants nor the inspissated juice of their leaves are mentioned by Hippocrates or Theophrastus; but both are described by Dioscorides¹ and Pliny.²

BOTANY. Gen. Char.—*Perianth* tubular, six-cleft, fleshy, nectariferous at the base, the sepals of the same form as the petals, and closely imbricating them. *Stamens* hypogynous, as long as the perianth, or even longer. *Capsule* membranous, scarious, three-corned, three-celled, three-valved, with a loculicidal dehiscence. *Seeds* numerous, in two rows, roundish or angular. (*Lindley*).—Succulent plants.

Species.—The following species furnish the greater part of the substance called in the shops *aloes*:—

1. ALOË VULGARIS, Lam. L. D.; *Aloë perfoliata* π, vera Linn.; *A. bardadensis*, Miller, Haworth; 'Αλόη, Dioscor. Sibth.—*Stem* woody, simple, cylindrical, short. *Leaves* fleshy, amplexicaul, first spreading, then ascending, lanceolate, glaucous, green, flat above, convex below, armed with hard, distant, reddish spines, perpendicular to the margin; a little mottled with darker colour; the parenchyma slightly coloured brown, and very distinct from the tough leathery cuticle. *Scape* axillary, glaucous reddish, branched. *Spike* cylindrical-ovate. *Flowers* at first erect, then spreading, afterwards pendulous, yellow, not larger than the stamens. (*Lindley*).—East Indies, Barbary, Spain, Italy, Sicily, Malta, Greece, West Indies.

Specimens of this species are frequently brought to London from the West Indies by sailors, a tarred cloth being closely tied around the truncated stem to prevent the escape of the juices of the plant. If suspended by a cord from the ceiling of a room, they continue to live for a considerable time, and throw out fresh leaves. I have had one in my possession for nearly two years, and it is still living and growing.

This species yields *Barbados aloes* (*Aloe Barbadosensis*, Ph. Lond.).—The brownish-yellow, bitter, resinous juice which, by inspissation, forms aloes, is contained in parallel greenish vessels beneath the epidermis of the leaves.

2. A. ABYSSINICA, Lam. is by some writers considered to be a variety of *A. vulgaris*. By Kunth it is regarded as a distinct species. Its flowers are greenish yellow. It is a larger and more resinous species than the preceding, and was brought from Africa by Bruce. It may, perhaps, yield a portion of the aloes of commerce. It contains a very bitter juice, which becomes brown in the air.

3. ALOË SOCOTRINA, Lam. De Cand.—*Stem* woody, straight, one and a half feet high or more, naked below, where it is strongly marked with the scars of leaves. *Leaves* amplexicaul, ascending, ensiform, green, curved inwards at the point, convex below, rather concave above, marked with numerous small white marginal serratures, the parenchyma abounding in a bright brownish-yellow juice. *Raceme* cylindrical, unbranched. *Flowers* scarlet at the base, pale in the middle, green at the point. *Stamens* unequal, three of them longer than the flowers. (*Lindley*).—Socotra; also, according to Nees von Esenbeck, Cape of Good Hope.

¹ Lib. iii. cap. xxv.

² Hist. Nat. lib. xxvii. cap. v.

Fig. 221.

*Aloë socotrina.*

Lient. Wellstead¹ says that the hills on the west side of Socotra are covered for an extent of miles with aloë plants; and he observes that it is not likely, at any future period, that the whole quantity will be collected which might be required.

It is said to yield *socotrine* (and *real hepatic*?) aloes.—Under the epidermis of the leaves are parallel greenish vessels containing the bitter resinous juice, as in the last-mentioned species. By drying, the leaves of *A. socotrina* (like those of *A. purpurascens*, but unlike those of *A. vulgaris*) acquire a purplish-red colour, which commences first in the parallel vessels, and is probably produced by the oxidation of the resinous juice contained in these vessels.

4. *A. PURPURASCENS*, Haworth.—This species has dark red flowers and glaucous leaves, which become purplish-red when drying. It has the same localities as the last-mentioned species. Its juice is very bitter and resinous, and becomes blood-red in the air.

5. *ALOE SPICATA*, Thunb. D.—*Stem* three to four feet high, as thick as a man's arm. *Leaves* thick, fleshy, broad at the base, gradually narrowing to the point, channelled, full two feet long, distantly toothed, with a few white spots; their parenchyma almost colourless. *Spike* a foot long, very compact, with the flowers campanulate and horizontal. The three petals broader, ovate, obtuse, white, with a triple green line, the sepals narrower, less concave. *Stamens* much longer than the perianth. The flowers are filled with a purplish honey. (Lindley.)—This species is a native of the interior of the Cape of Good Hope, and contributes to yield *Cape Aloes*. Thunberg² states that it yields the best hepatic aloes, ("succus Aloës hepaticus purus et optimus.")

6. *ALOE FEROX*, Lam.—*Stem* very lofty. *Leaves* perfoliate, thick, juicy, sword-shaped, deflexed, glaucous, prickly throughout, but bearing larger and sharper spines along the margins. *Flowers* racemose, crowded. *Stamens* double as long as the corolla. L. Pappe, *Fl. Capensis Med. Prodr.*—A native of Swellendam, Cape of Good Hope. Yields the best Cape aloes.

7. *ALOE AFRICANA*, Miller.—Yields Cape aloes almost equally good with *A. ferox*, but not so bitter, nor so powerful a drastic.

8. *ALOE Plicatilis*, Miller.—Inhabits the mountainous range near the Paarl, Drakenstein, and Fransche Hoek, at the Cape of Good Hope. It yields the aloes commonly used by the colonists, which is milder than the preceding, and much resembles Barbados aloes.

OTHER SPECIES.—It is probable that several other species contribute to the supply of the aloes of commerce. I have received four species from Mr. Dunsterville, of Algoa Bay, who writes that from all of them, as well as from other species, the so-called Cape aloes is obtained. Thunberg³ states that *A. perfoliata* yields a large quantity of aloes at the Cape, and he also says⁴ that *A. linguiformis*, Linn. yields the best and purest sort. Dr. Christison⁵ suggests that *A. Comelini* of Willdenow may yield some. He was informed, by Mr. John Lyell, that at Swellenden and George (South Africa), aloes is obtained from *A. spicata*, *A. Africana* of Haworth, and varieties of these crossed with *A. ferox*. The last-mentioned species is now cultivated in Barbados, according to Schomburgk.⁶

In Arabia, Forskål⁷ found *A. officinalis* (*A. rubescens* of De Candolle?), whose juice had the odour of the officinal socotrine aloes. Its flowers were red.

In India, there is also a species with reddish flowers, which Dr. Royle⁸ has called *A. Indica*. This, if known to Roxburgh, was probably included by him in *A. perfoliata*.

Nees von Esenbeck mentions the following species as being rich in a bitter resinous juice: *A. humilis*, Lam.; *A. Ferra*, De Cand.; *A. ferox*, Lam.; and *A. subferox*, Spreng. He also found that the following were feebly bitter, but in different degrees: *A. glauca*, Mill.; *A. paniculata*, Jacq.; *A. supanaria*, Haw.; *A. cæsia*, S. D.; *A. plicatilis*, Mill.; *A. arborescens*, Mill.; and *A. frutescens*, S. D. He says that *A. glauca*, Mill. was also slightly bitter, but that the juice became

¹ *Journal of the Royal Geographical Society*, vol. v.

² *Dissertatio Botanico-Medica de Aloë*, 1785.

³ *Diss. Med. Bot.* p. 10.

⁴ *Dispensatory*, 2d edit.

⁵ *Flora Ægyptiaco-Arabica*, p. 73, 1775.

⁶ *Ibid.* p. 7.

⁷ *Hist. of Barbados*, p. 590.

⁸ *Illustr. of the Botany of the Himalayan Mountains*.

dark brown in the air, which shows that this colouring matter is a peculiar principle originally different from the bitter matter.

PREPARATION.—The finest kind of aloes is obtained by evaporating the juice which flows spontaneously from the transversely-cut leaves. This juice is lodged in vessels running longitudinally beneath the epidermis. The exudation of it is promoted by gravity, by dipping the leaves in hot water, and by making fresh sections of the leaves. But if pressure be employed, the proper aloetic juice becomes mixed with the mucilaginous liquid of the leaves, and thus an inferior kind of aloes is obtained. A still commoner variety is procured by boiling the leaves, from which the juice has been previously allowed to escape, in water.

a. Of Socotrine Aloes.—In the Island of Socotra the leaves are plucked at any period, and by any one who chooses to take the trouble; and after being placed in a skin, the juice is allowed to exude from them.¹ The following mode of preparing socotrine aloes, as related by Hermann, was communicated to Ray by Dr. Palmer:² “When the leaves which have been pulled from the roots are gently compressed by the hand or an instrument, the juice drops from them into a receiving vessel; and being allowed to stand during a night deposits the grosser parts. The next day it is transferred to another vessel, in which it is exposed to the sun that it may harden and become dry, when it acquires a brownish-yellow colour.”

β. Of Barbados Aloes.—In Barbados, the aloes is best procured in the month of March. It is obtained as follows: “Every slave hath by him three or four portable tubs. The leaves being cut near the roots, are thrown into these with their broken ends downwards; and as the leaves are full of large longitudinal veins or vessels, they yield an easy passage to the juice (which is of a greenish-yellow colour) to drip out. This being boiled for about five hours in a copper or kettle, the watery particles evaporate, and the remainder comes to a consistency and thickening as sugar doth when sufficiently boiled. The way to know when it is enough boiled is, to dip a stick in the liquor, and observe whether the aloe sticking to it, when cold, breaks short: if it doth, then it is boiled to perfection, and fit to be poured into gourds or calabashes, or other vessels, for use.”³

Dr. Wright⁴ says, that in Jamaica, the leaves contained in hand-baskets or nets are boiled in water, and the strained liquor evaporated to a proper consistence, and then poured into gourds or calabashes. Dr. Patrick Browne,⁵ on the other hand, states that the sun-dried juice is called *socotrine aloes*; but the common aloes, he adds, is obtained by squeezing out the juice by the hand, adding water to it, and boiling down to a proper consistence.

γ. Of Cape Aloes.—The method of preparing aloes followed at the Cape of Good Hope has been described by Thunberg,⁶ Lieut. Moody,⁷ and others.⁸

Mr. George Dunsterville, surgeon of Algoa Bay, and formerly one of my pupils, has furnished me with the following information respecting the manufacture of Cape aloes: “A shallow pit is dug, in which is spread a bullock’s hide or sheep’s skin. The leaves of the aloe plants in the immediate vicinity of this pit are stripped off, and piled up on the skin, to variable heights. These are left for a few days. The juice exudes from the leaves, and is received by the skin beneath. The Hottentot then collects in a bucket or other convenient article the produce of many heaps, which is then put in an iron ppt capable of holding 18 or 20 gallons. Fire is applied to effect evaporation, during which the contents of the pot are constantly stirred to prevent burning. The cooled liquor is then poured into wooden cases of about three feet square by one foot deep, or into goat or sheep skins, and is thus fitted for the

¹ Welstead, *op. citato*.

² Dale, *Pharmacologia*.

³ Hughes, *Natural History of Barbados*, p. 154, 1750. This account is further confirmed by that of Mr. Millington, *Lond. Med. Journ.* vol. viii. p. 423. But Dr. Christison states, the Barbados aloes of the present day is the extract of a decoction.

⁴ *Lond. Med. Journ.* vol. viii. p. 219.

⁵ *History of Jamaica*, p. 198, 1789.

⁶ *Travels in Europe, Asia, and Africa, between the Years 1770 and 1799*, vol. ii. p. 49.

⁷ *Ten Years in South Africa*, vol. ii. p. 2, 1835.

⁸ *Four Months in Cape Colony*, in Chambers’s *Miscellany of Useful and Entertaining Tracts*, vol. xx. No. 173, Edinb. 1847; also, Mr. John Lyell in Christison’s *Dispensatory*, 2d ed.

market. In the colony, aloes realizes about 2½d. to 3½d. per lb." Mr. Dunsterville also informs me that the Hottentots and Dutch boors employ indiscriminately different species of Aloë in the preparation of Cape aloes. He adds, that "the Cape aloes, which is usually prized the highest in the English market, is that made at the Missionary Institution of Bethelsdorp (a small village about nine miles from Algoa Bay, and chiefly inhabited by Hottentots and their missionary teachers). Hence it is called *Bethelsdorp Aloes*. Its superiority arises, not from the employment of any particular species of Aloë, for all species are indiscriminately used; but from the greater care and attention paid to what is technically called 'the cooking of the aloes,' that is, to the evaporation, and to the absence of all adulterating substances (fragments of lime-stone, sand, earth, &c.) often introduced by manufacturers."

DESCRIPTION AND VARIETIES.—I am acquainted with seven commercial varieties of aloes; namely, *Socotrine*, *Hepatic*, *Barbados*, *Cape*, *Mocha*, *Caballine*, and *Indian*. To these must be added *Curacao Aloes*.

The terms socotrine, hepatic, and caballine, have been used to indicate rather the quality and purity, than the origin, of aloes. Thus Thunberg¹ says, "Pro diversa puritate potius, quam quidem sua origine, triplicem imprimis Aloës speciem in Pharmacopolis nostris introductam invenimus, scilicet *socotrinam*, *hepaticam*, et *caballinam*." And Jussieu² states that he saw all three varieties prepared at Morvedro, in Spain, from the Aloë vulgaris.

The term *Aloë lucida*, or *clear aloes*, has been applied by Schröder,³ Geoffroy,⁴ Fée,⁵ and others, to a clear or transparent aloes supposed to be formed by the concretion of the juice on the leaves after they have been incised. It is probable that by this term are meant the clearest and most transparent pieces of socotrine aloes. I have never met with, in English commerce, any aloes by this name: and a similar remark has been made by Alston.⁶

1. Socotrine Aloes (*Aloë socotrina*, L.; *Aloë socotorina* and *Aloë Indica*, E.).⁷ A few years ago this kind of aloes was brought by way of Smyrna, and hence was frequently termed *Turkey aloes*. But since the expiration of the charter of the East India Company, it is usually brought by way of Bombay. It is the kind sold at Apothecaries' Hall, London, and at other places under the name of *extract of spiked aloes* (*extractum aloës spicatum*), although there is no evidence of its being obtained from Aloë spicata. The London College (1851) states it to be the juice of the cut-off leaves, dried in the air, of an uncertain species of aloes. It comes over in skins⁸ contained in casks (holding from 11 to 15 cwt. each), kegs, and chests. Its consistence and colour are subject to considerable variation. The exterior portion of each skinful is usually hard, but the internal portion is frequently soft or even semi-liquid.

The hardened portions vary in colour in different parts of the same mass; sometimes they are garnet red, at other times much paler, and when quite dry are golden red, and yield a golden yellow powder. By exposure to the air the colour is deepened. The fracture of fine selected pieces is smooth, glassy, and conchoidal; but socotrine aloes of excellent quality often breaks with a roughish fracture. The finest kind of socotrine which I have met with had the semi-transparent red colour observed when we break a fine tear of myrrh. Thin films of pure and hardened socotrine aloes are usually translucent or nearly transparent. The fragments, which have a ruby colour, are called *aloe socotrina vera*. The odour of fresh broken pieces (especially when breathed on) is very fragrant, and is much stronger in recent and soft specimens. The same agreeable odour is obtained by heating the aloes on a point of a knife in a candle. By distillation with water, we obtain a liquid having the same odour, but free from any bitter taste. When fresh, socotrine aloes pos-

¹ *Dissertatio Botanico-Medica de Aloë*, 1785.

² *Elements of Chemistry*, by M. J. A. Chaptal, vol. iii. p. 86, 1791.

³ *The Compleat Chymical Dispensatory*, p. 500, 1669.

⁴ *Tractatus de Materia Medica*, t. ii. p. 649, 1741.

⁵ *Cours d'Hist. Nat. Pharm.* t. i. p. 327, 1828.

⁶ *Lectures on the Materia Medica*, vol. ii. p. 422, 1770.

⁷ I have received from Dr. D. MacLagan, Lecturer on Materia Medica in Edinburgh, two specimens of aloes; one marked "True Socotrine Aloes, garnet red in their fragments;" the other "Aloes given to me as True Socotrine, rough fracture nearly garnet red in thin fragments. Included under *Aloë indica*, Ed. Pharm." Both kinds are Socotrine aloes.

⁸ I am informed that they are the skins of the Gazelle.

sesses considerable acidity, and the late Mr. Hennell informed me that, in the preparation of the compound extract of colocynth, he had frequently observed the fatty acid of the soap set free by the acid of the socotrine aloes. I have been shown a sample of what was declared to be socotrine aloes, which was soft or semi-liquid, and had a bright or palm-oil yellow colour, and a very fragrant odour.

When a package of socotrine aloes arrives at a druggist warehouse, it is usually garbled or sorted. The finest, clear, and hard pieces are separated for sale. The soft portions are placed upon slabs or in shallow tin trays, or other vessels, and exposed to a very gentle heat to harden them (*hardened socotrine aloes*), and at the same time to preserve the favourite colour of this kind of aloes. Mr. Whipple, who has had great experience in these matters, informs me that "the loss would be frightful, if, after selecting or separating the clean aloes, the skins were not washed and the aloes obtained by subsequent evaporation."

It is brittle, bitter, reddish brown, with an aromatic odour; fresh thin films of it are translucent. *Ph. Lond.*

"In thin pieces, translucent, and garnet red; almost entirely soluble in spirit of the strength of sherry. *Very rare.*" *P. Ed.*

But socotrine aloes as imported is not "*in thin pieces*;" this character being given to it in the garbling process, or by drying the soft portions in thin layers as above mentioned. *Translucency* and a *garnet red* colour are qualities not possessed by many fine specimens of socotrine aloes. The *alcoholic strength of sherry* is subject to variation, and, therefore, the statement of the College as to the solubility of socotrine aloes is not very definite. Lastly, as to socotrine aloes being *very rare*, I may observe that the late Mr. Hennell, of Apothecaries' Hall, informed me (Dec. 21, 1841), that he would be happy to take an order for 500 lbs. of it.

The impure and dirty pieces of socotrine aloes are sometimes melted and strained (*strained socotrine aloes*), by which the colour and odour are impaired, and the other qualities somewhat altered.

Socotrine aloes has long been regarded as the best kind of aloes, though its commercial value is now below that of Barbados aloes. It is, I suspect, inferior in activity.

Socotrine aloes is mentioned by Avicenna and Mesue, both of whom regarded it as the best kind. By Fée,¹ and some other continental writers, it is confounded with Cape aloes.

The aloes prepared in the Island of Socotra is probably procured from *Aloë socotrina*; and perhaps also *A. purpurascens*. In 1833, the quantity exported from this island was 83 skins, or 2 tons. But a much larger quantity might be procured if required.² Two samples (one of which I have in my museum) brought direct from the Island of Socotra, by a friend of Professor Royle, are largely intermixed with foreign substances, as sand, skins, &c.

Sir Whitelaw Ainslie³ says, that the greater part of the extract now sold under the name of socotrine aloes is prepared in the kingdom of Melinda; and I am informed by an eminent drug merchant that both socotrine and hepatic aloes have been imported into London directly from Zanzibar.

2. Genuine Hepatic Aloes; Liver-coloured Socotrine Aloes (*Aloë hepatica*, L. D.; *Aloë Indica*, E.).⁴—This sort of aloes usually comes to London from Bombay (hence it is sometimes called *Bombay* or *East India Aloes*) in skins, contained in casks holding from 200 to 300 pounds,⁵ or in kegs. The London College (1851) declares it to be the "insipissated juice of the leaf?" of "an uncertain species of aloes." Its odour is very much the same as that of the socotrine kind, or perhaps it is a little

¹ *Cours d'Hist. Nat. Pharm.* t. i. p. 325.

² Wellstead, *Journ. Geograph. Soc.* vol. v.

³ *Materia Indica*, vol. i. p. 9.

⁴ I suspect hepatic aloes is included by the Edinburgh College under "*Aloë indica*." For, in preparing Decoction of Aloes, the College orders Socotrine or Hepatic Aloes, though the term hepatic does not occur in the list of *Materia Medica*.

⁵ Mr. Whipple informs me that it is "received in packages varying from 56 lbs. to 12 cwt. casks, most commonly in firkins. Lately, it has come over in boxes lined with tin, and holding about 56 lbs. All of these, except the last, contain the skin packages."

less fragrant. It is distinguished from the latter by its opacity and its liver colour. It might, therefore, be called *opaque liver-coloured socotrine aloes*. It appears to me to bear very much the same relation to the transparent or real socotrine aloes that the opaque yellow rosin bears to the dark transparent or fiddler's rosin. It is sometimes imported in a soft or liquid state, and in this condition I know not how to distinguish it from liquid socotrine aloes. The similarity of the odour of socotrine and hepatic aloes leads to the suspicion that they are obtained from the same plants; and which is further confirmed by the two being sometimes brought over intermixed, the socotrine occasionally forming a vein in a cask of hepatic aloes. Some samples of hepatic aloes, when digested in rectified spirit of wine, yield a tincture, at the bottom of which there remains undissolved a yellowish granular powder (in appearance something like lycopodium), which is insoluble in water, alcohol, ether, and dilute sulphuric acid, but is readily soluble in a solution of caustic potash, forming a red-coloured liquid.

The place of produce of this species is probably the same as that of the so-called socotrine aloes.

Opaque, liver-coloured, bitter, with an unpleasant odour. *Ph. Lond.*

3. Barbados Aloes; *Aloë in gourds (Aloë barbadensis*, Ph. L. and Ed.)—This is the kind denominated by most continental writers (as Geiger, Theod. Martius, Pfaff, Fée, and others), *hepatic aloes (aloë hepatica)*, but its colour is not constantly that of the liver. It is imported from Barbados or Jamaica usually in gourds (*Lagenaria vulgaris*), weighing about 60 to 70 pounds, or even more than this; and sometimes in cases or boxes holding 56 lbs. each. The hole in the gourd-shell is partially closed by a piece of gourd let in and covered by a portion of coarse cloth, which is nailed down over the aperture.

The finest Barbados aloes is the inspissated juice, which I have heard called by an inhabitant of the island *cold drawn Barbados aloes*, to distinguish it from the extract of the decoction, which is of inferior quality.

Barbados aloes varies in colour from a dark brown or black (*brown or black Barbados aloes*) to a reddish-brown or liver colour (*liver-coloured or hepatic Barbados aloes*): even in the same gourd a difference of colour is occasionally observed. The fracture also varies, sometimes being dull, at other times glossy, or even resinous. Its unpleasant odour (which is much increased by breathing on it) will always distinguish it from the foregoing kinds. Its powder is of a dull olive-yellow colour. This kind of aloes is obtained chiefly, if not exclusively, from the *Aloë vulgaris*.¹

The London College (1851) declares it to be the "inspissated juice of the cut-off leaves of *Aloe vulgaris*."

Opaque, not glistening, liver-coloured, becoming blackish, with a bitter nauseous taste, and very unpleasant odour.—*Ph. Lond.*

The quantity of aloes annually exported from Barbados is stated by Sir R. H. Schomburgk (op. cit. pp. 149, 150, and 160) to be as follows:—

1740	}	average annually	327 gourds.
1748			
1792			515 gourds.
1841			1361 gourds.
1842			2956 gourds, 1 case, 1 package.
1843			4227 gourds, 8 puncheons, 27 boxes.
1844			2371 gourds, 2173 packages, and 78 boxes.
1845			1958 packages.

4. Cape Aloes (*Aloë capensis*; *A. lucida* of Geiger).—This kind is imported, as its name indicates, from the Cape of Good Hope. It is brought over in chests and skins, the latter being preferred, as the aloes contained therein are usually purer

¹ Dr Maycock (*Flora Barbadosensis*, 1830) notices no other species of *Aloe* indigenous, naturalized, or cultivated in Barbados. But Dr. Christison observes that, though at one time Barbados aloes was made only from *A. vulgaris*, he is assured by various pupils from that island that, while this species is commonly used, others are likewise employed. Sir R. H. Schomburgk (*History of Barbados*, p. 590, 1847) mentions *A. ferax*, Lam. or Great Hedge-hog Aloe, as having been introduced from the Cape of Good Hope. Kunth (*Enum. Plant.*) says, but I know not on what authority, that *A. socotrina* is cultivated at Barbados.

and more glossy. It has a shining resinous appearance, is of a deep brown colour, with a greenish tint, and has a glossy or resinous fracture; its edges, or thin laminæ, viewed by transmitted light, have a yellowish red or ruby colour; its odour is stronger and more disagreeable than the Barbados aloes; its powder is greenish yellow. Some of the commoner kinds of Cape aloes have a rough fracture. The finest kind of Cape aloes is called *Bethelsdorp aloes* (see *ante*, p. 196).

Occasionally it has been imported of a reddish-brown colour, like that of the liver, and opaque (*liver-coloured* or *hepatic Cape aloes*). Some years since an experienced dealer bartered 3 lbs. of Cape aloes for 1 lb. of what he thought to be the genuine hepatic aloes, but which turned out to be a fine sort of Cape aloes. I presume this is the kind which Professor Guibourt,¹ to whom I sent a specimen of it, formerly termed *false hepatic aloes*; and which more recently² he calls *opaque Cape aloes*. Its odour, when breathed on, instantly detects it.

I have received four species of *Aloë* plants from Mr. Dunsterville, of Algoa Bay, and the four extracts which he was informed were obtained respectively from the species sent. Two of the plants were dead and rotten; and the others were unknown to the late Mr. Anderson, of the Chelsea Gardens. The four extracts are as follows:—

a. Ordinary Cape Aloes.—Dark, glossy, very resinous, with a strong disagreeable odour, and greenish tint.

β. Socotrine Cape Aloes.—This, in colour, resembled socotrine aloes; but it was more glossy, brittle, and transparent. Its odour, though disagreeable, was less so than the first kind.

γ. Hepatic Cape Aloes.—This is an intermixture of an opaque liver-coloured extract (*hepatic Cape aloes*) with a dark, glossy, transparent extract.

δ. This very much resembled the preceding, and might equally claim for its opaque portion the name of *hepatic Cape aloes*.

Cape aloes is procured from *Aloë spicata* and other species (see *ante*, p. 194).

5. Fetid, Horse, or Caballine Aloes (*Aloë caballina*).—I have never met with any particular kind of aloes under this name in English commerce; Barbados aloes being used in England for horses. From Prof. Guibourt I have received two substances, which he denominates *Aloës Caballin*.

a. One is impure or foot Cape aloes.

β. The other is in black opaque masses, intermixed with straws, pieces of bark, sand, charcoal, and other impurities. Its fracture is uniform. It is difficult to pulverize, adheres to the pestle, gives a greenish powder, has a very little odour, and yields a dark brown decoction. It is probably an extract prepared by boiling the leaves in water.

Guibourt says Caballine aloes is procured either in the countries which furnish ordinary aloes, or in Spain³ or Senegal.

6. Mocha Aloes (*Aloë de Mochâ*).—Under this name, I found in a drug warehouse, where it had lain for many years, an impure kind of aloes, in large irregular masses, opaque, and black externally, intermixed with sand, strings, &c. In its brittleness, odour, and the pale colour of its decoction, it resembles Cape aloes. The interior of the mass is not uniform: in some places it is dark and opaque, somewhat like Barbados aloes; in other places it resembles socotrine aloes, and here and there we find portions having the transparency and resinous appearance of Cape aloes. Recently, this kind of aloes has been imported under the name of Mocha aloes from Muscat, in chests containing nearly 2 *cwt.* each.⁴ Dr. Christison thinks it is East Indian aloes of low quality. It is described by Guibourt under the name of *blackish* or *fetid aloes* (*aloës noirâtre et fétide*).

7. Indian Aloes (*Aloë indica*; not the *Aloe indica* of the Edinburgh Pharmacopœia).—Dr. O'Shaughnessy⁵ mentions two kinds of Indian aloes: *Kurachee* aloes, nearly black, opaque, and soluble in water to the extent of 52 per cent.; and *Deccan* aloes, deep brown, and soluble to the extent of 98 per cent.

¹ *Hist. des Drog. simpl.* 3me édit. t. ii. p. 418.

² *Ibid.* 4me édit. p. 168.

³ Formerly the inhabitants of Morviedro, in Valencia, cultivated the aloe plant (*A. vulgaris*), and obtained from it three kinds of aloes, called respectively socotrine, hepatic, and caballine (Jussieu in Chaptal's *Elements of Chemistry*, vol. iii. p. 86); but Laborde (*View of Spain*, vol. i. p. 302, 1609) says the cultivation is now neglected.

⁴ Mr. Whipple tells me that, in dissolving and straining Mocha aloes, he has never found less than 25 per cent. of impurities (sand, stones, &c.).

⁵ *Bengal Dispensatory*.

Through the kindness of Professor Royle, I have examined four kinds of aloes brought from the interior of India :—

- a. *Aloes from Northern India*.—Is dull, black, and brittle, and has little odour. It came from the northern parts of India, where it is common in the bazaars (*Bazaar aloes*). It is probably the kind which Ainslie¹ says resembles Barbados aloes, and is brought to India from Yemen, in Arabia. Is this the produce of *Aloe officinalis*, Forskäl?
- β. *Guzerat Aloes*.—Is dark, more gummy in its appearance and feel, more difficult to fracture.
- γ. *Salem Aloes*.—In blackish masses. It was brought from Salem. It is distinguished from all the preceding by the numerous large air cavities observed in its interior. Its odour is analogous to that of socotrine aloes. Its price is marked one anna and nine pie [about two-pence halfpenny] a pound.
- δ. *Trichinopoly Aloes*.—Resembles Cape aloes in its brittleness, odour, and colour, but is more opaque. Its price is marked at two annas [about three-pence] a pound.

These aloes are the produce, in part at least, of *Aloë indica*;² a species with reddish flowers, common in dry situations in the northwestern provinces of India, and which, if known to Roxburgh, was included by him in the *A. perfoliata*, Linn., and perhaps also of *A. vulgaris*, or the plant mentioned by Rheede.³

8. Curacao Aloes.—This species of aloes is not known in the London market, but a notice of it has been published by Mr. A. Faber.⁴ It is the produce of the Dutch West India Island, Curacao; but as even in Holland it cannot be regularly obtained, it is probable that its production is scanty.

It is most like Cape aloes, but does not possess the greenish colour which is sometimes perceived in the latter; its appearance is more dull; and its colour is often that of the liver. From hepatic aloes it differs by its saffron-like odour. It is probably the produce of *A. vulgaris*.

Powdered Aloes.—In January, 1846, the lecture assistant of the Pharmaceutical Society carefully powdered selected samples of five kinds of aloes in the Society's museum. The colour of the various powders were as follows:—

Powders.

- No. 1. Cape aloes . . . Lightest colour. Tint, pale yellow.
 “ 2. Hepatic aloes } Nearly alike. Deeper coloured than No. 1. No. 2 had a reddish, No. 3 a greenish
 “ 3. Barbados aloes } tint.
 “ 4. Socotrine aloes { Both darker than the three preceding sorts. That of No. 4 had
 “ 5. Mocha aloes. Darkest colour { the tint of, but was less deep than, roasted chicory powder;
 that of No. 5 was clive or greenish. In twelve months, No. 4 had become coherent and darkest of all.

Strained Aloes; Aloë colata.—In order to deprive aloes of the various foreign matters with which they are frequently mixed, the wholesale druggist purifies the extract by melting and straining it. The fusion is effected in a metallic vessel heated by steam or hot water, a hair or wire sieve being used for straining the liquor. By this process the aloes suffers a physical, and probably also a chemical change. It becomes darker coloured, harder, and somewhat less odorous. It is probable that the deepened colour is produced by the action of atmospheric oxygen.

COMPOSITION.—Aloes has been analyzed by Trommsdorff,⁵ by Bouillon-Lagrange and Vogel,⁶ by Braconnot,⁷ and by Winkler.⁸

Trommsdorff.			Bouillon-Lagrange and Vogel.			Braconnot.		Winkler.		
Socotrine. Barbados.			Soc. Bar			Soc.		Soc. Bar		
Saponaceous principle	75	81.25	Extractive	68	52	Bitter principle	73	Bitter matter	50	60
Resin	25	6.25	Resin	32	42	Puce do.	26	Resin	50	35
Vegetable albumen	0	12.5	Vegetable } albumen }	0	6	Impurities	1	Albumen	0	5
Gallic acid	trace	trace								
Aloes	100	100.00		100	100		100		100	100

¹ *Mat. Ind.* vol. ii. p. 10.

² Royle, *Bot. of the Himalayan Mountains*.

³ *Pharmaceutical Journal*, vol. vii. p. 547, 1848.

⁴ *Ibid.* p. 155.

⁵ Geiger, *Hand. d. Pharm.* Bd. ii. 782, 1829.

⁶ *Hort. Malab.* ii. t. 3.

⁷ *Ann. de Chim.* t. lxxviii. p. 11, 1808.

⁸ *Journ. de Physiq.* t. lxxiv. p. 334, 1817.

1. **ALOESIN**, Pfaff (*Saponaceous Matter; Extractive; Bitter Principle of Aloe or Aloe bitter; Aloin*).—This is the principal constituent of aloes. It is contained in the cold infusion of aloes, and also in a decoction which has cooled: it may be obtained from either by evaporation. Thus procured, it is a brown and bitter mass, readily soluble in water, but difficultly so in spirit of wine. In pure alcohol or ether it is said to be insoluble, or nearly so. Besides *carbon*, *hydrogen*, and *oxygen*, it contains *nitrogen*, for it yields ammonia by destructive distillation, and furnishes carbazotic acid when treated by nitric acid. Aloesin is probably a mixture or compound of various proximate principles. Obtained as above, Braconnot says it contains some of the *puce-coloured principle*, which may be removed by oxide of lead.

2. **ALOE RESIN**.—The substance which deposits from a decoction of aloes as it cools is usually denominated resin. Braconnot says it is a mixture of aloesin and *puce-coloured principle*; while Berzelius regards it as *apothème* combined with unaltered extract. It is transparent, brown, fusible, soluble in alcohol, ether, and alkaline solutions. The *puce coloured principle* of Braconnot is an odourless and tasteless powder, combustible, but not fusible; and is prepared by digesting aloes with water and oxide of lead: a compound of the puce principle and the oxide is procured, which is to be washed and decomposed by weak nitric acid: the oxide is dissolved, and the puce principle left. From Braconnot's observations, this principle seems to be rather oxidized extractive (*apothème*, Berz.) than resin.

3. **VEGETABLE ALBUMEN**.—This term is applied to a substance insoluble in both water and alcohol.

4. **ALOESIC ACID**.—This is the acid which Trommsdorff supposed to be *gallic acid*. A solution of aloes reddens litmus, darkens ferruginous solutions, but does not precipitate gelatin: hence Trommsdorff assumed the presence of gallic acid. But while gallic acid causes a blue colour with the persalts of iron, infusion of aloes produces an olive brown one. Furthermore, if excess of diacetate of lead be added to this infusion, and sulphuretted hydrogen be passed through the filtered liquor, to throw down the excess of lead, the boiled and strained liquor possesses the property of becoming olive brown on the addition of sesquichloride of iron. Hence it appears to me that the acid is a peculiar one, and I have accordingly termed it *aloesic acid*. It must not be confounded with an acid obtained by the action of nitric acid on aloes, and which has been termed *aloetic acid*.

Meissner¹ has given the name of *Aloïne* to a supposed alkali in aloes. Its solution was brown, and acted as an alkali on reddened litmus paper. With sulphuric acid, aloïne formed a crystalline salt.

Winkler² regards aloes as a neutral vegetable salt, composed of two peculiar basic substances (viz., a non-bitter resin, and a bitter substance) and an acid, viz., a colouring, non-bitter matter.

Fabroni³ obtained a fine violet colour from the recent juice of the Aloë, which has been proposed as a dye for silk. It is formed by the action of the oxygen of the air on the juice.

Messrs. T. and H. Smith⁴ have obtained a yellow crystalline substance from aloes, to which they have given the name of *aloiné*. Its composition is stated by Dr. Stenhouse to be $C^{34}H^{18}O^4$. In doses of one or two grains it operates as a purgative.

CHEMICAL CHARACTERISTICS.—Aloes is almost completely soluble in boiling water. When the decoction of aloes cools, the substance called *resin* is deposited. The clear cold solution (*aloesin*) reddens litmus, strikes a deep olive-brown tint (*aloosate of iron*) with sesquichloride of iron, is deepened in colour by alkalis, but is unchanged with gelatine. Diacetate of lead forms a copious yellow precipitate with it.

The alcoholic tincture of aloes does not become turbid when mixed with water. When the ethereal tincture is poured in water, the ether evaporates, and leaves a film of resin.

The bitter principle of aloes (*aloesin*) is distinguished from that of rhubarb by its not striking a green colour with the salts of iron, and by its insolubility in ether.

The differential chemical characters of the various kinds of aloes are not constant. The following, however, are the results of some experiments:—

a. *Cape aloes*, when good, usually completely dissolves in boiling water, leaving no residuum of vegetable albumen, &c. The decoction is clear, usually paler than that of the other kinds, and deposits much of the so called resin in cooling.

β. *Barbados aloes* sometimes leaves an insoluble residuum (vegetable albumen, &c.) when boiled in water. The decoction, when cold, is dark and usually turbid: generally, it is darker than that of the other sorts, yet I have found it the palest. I have also observed that the

¹ Pfaff's *Mat. Med.* vol. vii. p. 171.

² *Ann. de Chim.* xxv. 301.

³ Schwartz, *Pharm. Tabell.* p. 204, 2te Ausg.

⁴ *Chemical Gazette*, March 15, 1851.

decoction on cooling becomes turbid, and lets fall a yellow powder like that which I have seen in decoction of hepatic aloes.

γ. *Saccharine aloes* yields a decoction which, when cold, is dark and nearly clear.

δ. *Hepatic aloes* yields a decoction which, on cooling, frequently deposits a yellow powder.

Products of the decomposition of aloes by nitric acid.—When aloes is heated with nitric acid, nitrous fumes are evolved, and the principles of which aloes consist are oxidized. The residuum has an intensely bitter taste, and is termed *artificial aloes bitter* (*künstliches Aloeöl*.) It is a mixture of several principles.

The products of the action of nitric acid on aloes have occupied the attention of several distinguished chemists; but the results of their experiments, though highly interesting, are not uniform. Braconnot¹ and Chevreul² examined the reaction. The former applied the term *aloetic acid* to the residual solid, which Liebig³ subsequently declared to be a mixture of *nitric* or *nitrous acid*, *carbazotic acid*, and a *peculiar, non-acid, resinous, red matter*. Boutin⁴ has more recently examined the reaction of nitric acid on aloes, and he states the products to be *polyhydro-matic acid* (the aloetic acid of Braconnot) composed, according to Pelouze, of $C^{15}H^{22}N^{2}O^{13}$, *oxalic acid*, *carbazotic acid*, and *cyanile*. Schunk⁵ states that, by the action of nitric acid on aloes, he obtained four peculiar acids, viz., *aloetic acid*, *aloëresinic acid*, *chrysammic acid*, $C^{15}HN^{2}O^{12}+HO$, and *chrysolepic acid*, $C^{12}H^{22}N^{3}O^{13}+HO$.

Mulder⁶ has recently examined the products of the reaction of nitric acid on aloes. *Anhydrous chrysammic acid*, he says, consists of $C^{14}HN^{2}O^{11}$. The so-called *chrysolepic acid* he considers to be identical with nitropicric acid (*i. e.* carbazotic acid). He found the composition of the foliaceous crystals of this acid to be $C^{12}H^{23}N^{3}O^{14}$.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—Not ascertained.

β. *On Animals.*—Aloes is the ordinary purgative for solipedes (the horse, the ass, the zebra, &c.), as it is both safe and sure. In horses, previously prepared by two or three bran-mashes to soften the dung, the dose is from five to seven drachms.⁷ It acts slowly, requiring from eighteen to forty-eight hours for its operation.⁸ Mr. Youatt informs me that aloes is a valuable purgative for the dog, in doses of from one to three drachms, and with the addition of from one to three grains of calomel. Barbados aloes is preferred by veterinarians, as being more effective than Cape aloes, in the ratio of about seven to five. Aloes proves purgative to oxen, sheep, and pigs, but, as in the other cases, it operates slowly.⁹ Moiroud¹⁰ injected into the veins of a horse four drachms of aloes dissolved in water with a little alcohol, and the next day an ounce more, without any other effect than the evacuation of a large quantity of urine. The dung, however, was enveloped by a thin pellicle formed by altered intestinal mucus. This was collected and analyzed subsequent to the death of the animal (which followed three days after the injection): it offered scarcely any traces of the constituents of the bile.

γ. *On Man.*—Taken internally in small doses aloes acts as a tonic to the alimentary canal, assisting the digestive process, strengthening the muscular fibres, and promoting the secretions, especially that of the liver, which organ it is thought specifically to influence. In large doses it acts as a purgative. There are, however, some peculiarities attending its cathartic operation deserving of notice. In the first place, these effects are not so speedily produced as by some other purgatives; for eight, twelve, and sometimes twenty-four hours elapse before they are produced. Secondly, aloes acts especially on the large intestines, and a full dose is in some persons apt to produce heat and irritation about the rectum, and tenesmus; and, in those troubled with hemorrhoids, it is said not unfrequently to increase, or even to bring on, the sanguineous discharge. Fallopius¹¹ tells us, that of one hundred persons who used aloes as a purgative, ninety were affected with the hemorrhoidal flux, which ceased when the use of aloes was omitted. But though this statement has been often quoted as an objection to the use of aloes, it is of little importance, as there is no evidence that the disease was brought on by aloes. The uterus, in

¹ *Ann. de Chimie*, lxxviii. 28.

² Poggendorff's *Annalen*, xiii. 205; also, Liebig and Poggendorff's *Handwörterbuch d. Chemie*, S. 265, 1837.

³ *Journ. d. Pharmacie*, t. xxvi. p. 185.

⁴ *Buchner's Repertorium*, 3te Reihe, Bd. ii. 1849.

⁵ Moiroud, *Pharm. Vétér.* p. 26.

⁶ *Op. cit.*

⁷ *Ibid.* lxxiii. 46.

⁸ *Ann. der Chemie*, Bd. xxxix.

⁹ Youatt, *The Horse*, p. 211.

¹⁰ *Wibmer's Wirk. d. Arzneim.*

¹¹ *Opera Omnia*, p. 109, Francof. 1600.

common with all the pelvic viscera, is stimulated by aloes. A determination of blood towards these organs, and a fulness of the blood-vessels (especially of the veins), are produced, and thus uterine irritation and menorrhagia are apt to be increased by aloes, while in amenorrhœa and chlorosis it may occasionally act as an emmenagogue. Dr. Wedekind¹ says that small doses of aloes often occasion erection, and increase the sexual feelings.

The purgative effects of aloes do not arise merely from their local action on the alimentary canal, since this effect is sometimes produced when the medicine has been neither swallowed nor given by the rectum. Thus *Monro primus*² tells us, that the tincture of aloes applied to a caries of the bone produced purging; and it is said³ that an aloetic pill used as a stimulant to an issue had a similar effect; lastly, applied to a blistered surface it has the same operation. So that the purgative action of aloes appears to be of a specific kind.

According to Dr. Wedekind,⁴ the operation of aloes depends on the increased secretion of bile, which is produced by the specific action of this medicine on the liver. He founds this opinion on the results of various experiments. Thus, he says, that if aloes be added to purgatives (a laxative infusion and sulphate of soda), whose operation is speedy, its effects do not take place for some hours after those caused by the other purgatives; and he also asserts that the evacuations in the second purging differ from those of the first both in appearance and smell. Moreover, he found that, as long as the stools were white or gray in icterus, the aloes did not purge even when exhibited in large doses; but the purgative effect supervened immediately after the fecal matter began to contain bile, proving that the presence of bile in the intestinal canal is a necessary condition of the purgative effect of aloes. But in Moiroud's experiment, above quoted, no effect seemed to be produced on the hepatic secretion.

In all probability, the increased secretion of bile, the irritation about the rectum, the disposition to hemorrhoids, and the vascular excitement of the sexual organs, all of which are said to be produced by aloes, are the effects of a stimulant action exerted by this medicine over the venous system of the abdomen, and especially of the pelvis.

Dr. Greenhow⁵ ascribes a diuretic effect to aloes, and his statement is corroborated by Moiroud's experiment.

Socotrine aloes is said not to be so apt to occasion hemorrhoids as the Barbados kind. Some years since, Dr. Clutterbuck instituted numerous experiments at the General Dispensary, Aldersgate Street, which I witnessed, to determine the effects of the different kinds of aloes, but scarcely any difference in their operation on the human subject was perceptible. However, it is probable that Cape aloes is less powerful in its action on man, as it is on the horse, than the Barbados kind. But the difference is the less obvious in the human subject, on account of the comparative smallness of the dose required to produce the purgative effect.

As a purgative, aloes holds an intermediate rank between rhubarb and senna. Vogt⁶ places it between jalap and rhubarb. From rhubarb it is distinguished by its more stimulant influence over the large intestines and the pelvic organs: from senna by its feebler action as a purgative, by its slow operation, and by its tonic influence when given in small doses. It irritates less powerfully than either jalap or scammony: further, its influence over the blood-vessels of the pelvic viscera is greater than these.

USE.—The uses of aloes may be readily inferred from the remarks already made. It is evidently not adapted for those cases in which a speedy effect is required; and it is, therefore, useless to add it to purgatives to quicken their operation. It is well fitted for cases of costiveness where there is a scanty secretion of bile, and for

¹ *Rust's Magazin*. 1827, Bd. 24, Heft 2, S. 304.

² *Works*, p. 300, 1784.

³ *Op. cit.*; also, *Lancet*, vol. i. p. 347, 1827-8.

⁴ *Lond. Med. Gaz.* vol. xix. p. 270.

⁵ *Mém. de la Soc. Roy. de Méd. Paris*, tom. ii. p. 162.

⁶ *Pharmakodynamik*, Bd. ii. S. 334, 2te Aufl.

torpid conditions of the large intestines, especially when attended with deficient uterine action. Some of the ill effects ascribed to the use of aloes are probably imaginary, and others are much exaggerated.¹ It is, however, advisable to avoid the use of this purgative in inflammatory conditions and organic diseases of the liver, in biliary calculi, in mechanical impediments to the passage of the blood through the branches of the portal veins, in hemorrhage from any of the pelvic organs (as the uterus and rectum), in irritation of the rectum, prostate gland, or bladder, in pregnancy, &c. For we have many other equally efficient purgatives, to the use of which, in these cases, no ill consequences have been ascribed. While, therefore, I concur with Dr. Fothergill² in advising that the exhibition of aloes should be avoided when the menses are about to cease, I am not prepared to admit that "the piles, strangury, immoderate discharges of the menses, racking pains in the loins, representing labour pains, and other similar complaints," are frequently induced by this medicine. On the contrary, I suspect this catalogue of the evils of aloetic purges to be much overcharged. "Aloetic medicines," says Dr. Denman,³ "are forbidden during pregnancy, lest they should do mischief by their supposed deobstruent qualities; but they are cheap, and conveniently given in the form of pills, and I have not observed any bad effects from them." The emaciation, stricture of the rectum, and enteritis, referred by Dr. Greenhow⁴ to the long-continued use of aloetic medicines, ought, doubtless, to be ascribed to other causes.

The following are some of the cases in which the use of aloes has been advised:—

1. *In loss of appetite and dyspepsia*, depending on a debilitated condition of the digestive organs, accompanied by costiveness, but unattended with any signs of local irritation, aloes may be given in small doses as a stomachic.

2. *In habitual costiveness*, depending on deficiency of bile, or on a sluggish condition of the large intestines—particularly in hypochondriacal or studious persons, or in those whose habits or occupations are sedentary—aloes, given in sufficient doses to purge, will be found a very useful medicine. A torpid state of the colon, with large fecal accumulation, is not unusual in females.⁵ In such, the use of aloes is often attended with much benefit.

3. *To excite the menstrual discharge*, aloes is frequently employed. It has been supposed that, by determining an afflux of blood to the pelvic organs, aloes would stimulate the uterine vessels, and thus relieve deficient menstruation connected with atonic conditions of the uterus. But it often fails: indeed, Dr. Cullen⁶ says that it rarely succeeds.

4. *To reproduce the hemorrhoidal discharge*, aloes has been frequently employed in large doses. Serious affections of the head, or of other parts, have sometimes disappeared on the occurrence of the hemorrhoidal flux; and, therefore, in persons who have been subject to this discharge, but in whom it has stopped, it is advisable to attempt its re-establishment, with the view of relieving other more serious disorders.

5. *To promote the secretion of bile* where a deficiency of this fluid does not arise from hepatic inflammation; as in some forms of jaundice which are unconnected with biliary calculi, inflammation, mechanical obstruction of the ducts, &c.

6. *In cerebral affections*.—The compound decoction of aloes is a most valuable stimulating purgative for elderly persons in whom a tendency to apoplexy exists, especially in cold and phlegmatic habits. It will frequently be necessary to conjoin other cathartics, as the infusion of senna.

7. *As an anthelmintic*, a decoction of aloes, used as an enema, has been efficacious in the small thread-worm (*Ascaris vermicularis*).

ADMINISTRATION.—On account of its nauseous taste, aloes is frequently given in the form of pill (*pilulæ aloeticæ*, offic.). One or two grains seldom fail to pro-

¹ On the Use and Abuse of Aloes, London Medical Gazette, vol. iv. p. 139.

² Med. Obs. and Inq. vol. v. p. 173.

³ Introd. to the Pract. of Midwifery.

⁴ Lond. Med. Gaz. vol. xix. p. 270.

⁵ Copland, Dictionary of Practical Medicine, art. Colon, torpor of.

⁶ Treat. of the Mat. Med.

duce one stool, which seems to be merely an evacuation of what may be supposed to have been present for the time in the great intestines (Cullen). The ordinary dose is five grains; but ten, fifteen, or even twenty grains are sometimes given.

1. *PILULA ALOËS COMPOSITA*, L. D.; *Pilulæ Aloës*, E.; *Compound Pills of Aloes*.—(Socotrine Aloes [Hepatic, D.], powdered, $\mathfrak{z}\text{j}$; Extract of Gentian $\mathfrak{z}\text{ss}$; Oil of Caraway mxl . [$\mathfrak{f}\mathfrak{z}\text{ss}$, D.]; Treacle, as much as may be sufficient [$\mathfrak{z}\text{ss}$, D.] L.; beat them together until incorporated. The *Edinburgh College* orders of Socotrine Aloes and Castile Soap *equal parts*; Conserve of Red Roses a sufficiency; beat them into a proper pill mass. This pill may be also correctly made with the finer qualities of East Indian Aloes, as the Socotrine variety is very scarce; and many, not without reason, prefer the stronger Barbados Aloes, E.)—This pill is a valuable purgative in habitual costiveness. Dose, five to fifteen grains.

2. *PILULA ALOËS CUM MYRRHÂ*, L. D.; *Pilulæ Aloës et Myrrhæ*, E. [U. S.]; *Pilulæ Rufi*, offic.; *Pills of Aloes and Myrrh*; *Rufus's Pills*.—(Socotrine or Hepatic Aloes $\mathfrak{z}\text{ss}$ [*four parts*, E.]; Saffron $\mathfrak{z}\text{ij}$ [*one part*, E.]; Myrrh $\mathfrak{z}\text{ij}$ [*two parts*, E.]; Soft Soap $\mathfrak{z}\text{ij}$; Treacle [Conserve of Red Roses, E.], as much as may be sufficient. Rub the aloes and the myrrh separately to powder; then beat the whole together until incorporated [Aloes $\mathfrak{z}\text{ij}$; Myrrh $\mathfrak{z}\text{j}$; Saffron $\mathfrak{z}\text{ss}$; Syrup q. s. M. To be divided into 480 pills, U. S.].—Used as a purgative in chlorosis and amenorrhœa. Dose, ten to twenty grains.

3. *PILULA ALOËS CUM SAPONE*, L.; *Pilula Aloës diluta*; *Pills of Aloes and Soap*.—(Extract of Barbados Aloes powdered, Soft Soap, Extract of Liquorice, *equal parts*; Treacle as much as may be sufficient. Beat the aloes with the soap; then, having added the others, beat the whole together until incorporated.)—Dose, grs. v to grs. x.

4. *PILULÆ ALOËS ET ASSAFËTIDÆ*, E. [U. S.]; *Pills of Aloes and Assafetida*.—(Aloes [Socotrine or East Indian], Assafetida, and Castile Soap, *equal parts*. Beat them, with Conserve of Red Roses, into a proper pill mass.)—Used in dyspepsia attended with flatulence and costiveness. Dose, ten to twenty grains.

5. *PILULÆ ALOËS ET FERRI*, E.; *Pills of Aloes and Iron*.—(Sulphate of Iron *three parts*; Barbados Aloes *two parts*; Aromatic Powder *six parts*; Conserve of Red Roses *eight parts*. Pulverize the aloes and sulphate of iron separately; mix the whole ingredients, and beat them into a proper mass, which is to be divided into five-grain pills.)—A valuable emmenagogue in atonic amenorrhœa and chlorosis. Dose, one to three pills.

6. *PULVIS ALOËS COMPOSITUS*, L.; *Compound Powder of Aloes*.—(Socotrine or Hepatic Aloes $\mathfrak{z}\text{iss}$; Guaiacum Resin $\mathfrak{z}\text{j}$; Compound Powder of Cinnamon $\mathfrak{z}\text{ss}$. Rub the aloes and the guaiacum resin, separately, to powder; then mix them with the compound powder of cinnamon.)—Purgative and sudorific. Seldom used. Dose, ten to twenty grains.

7. *PULVIS ALOËS CUM CANELLÂ* [U. S.]; *Iliera Picra*, offic.; *Powder of Aloes and Canella*.—(Hepatic Aloes lbj ; Canella bark $\mathfrak{z}\text{ij}$. Powder them separately, and then mix.)—A popular emmenagogue. Dose, five to fifteen grains.

8. *DECOCTUM ALOËS COMPOSITUM*, L. D.; *Decoctum Aloës*, E.; *Compound Decoction of Aloes*.—(Extract of Liquorice $\mathfrak{z}\text{vij}$ [$\mathfrak{z}\text{ss}$, E. D.]; Carbonate of Potash $\mathfrak{z}\text{j}$ [$\mathfrak{z}\text{ij}$, E. D.]; Extract of Socotrine Aloes [Hepatic, D., or Socotrine, E.] powdered, Myrrh powdered, Saffron, of each $\mathfrak{z}\text{iss}$ [$\mathfrak{z}\text{j}$, E. D.]; Compound Tincture of Cardamom $\mathfrak{f}\mathfrak{z}\text{vij}$ [$\mathfrak{f}\mathfrak{z}\text{iv}$, E., as much as is sufficient, D.]; Distilled Water Oiss [$\mathfrak{f}\mathfrak{z}\text{xv}$, E., $\mathfrak{f}\mathfrak{z}\text{xiv}$, D.]. Boil down the liquorice, carbonate of potash, aloes, myrrh, and saffron, with the water, to a pint [$\mathfrak{f}\mathfrak{z}\text{xij}$, E.], and strain; then add the compound tincture of cardamom [as much as will make sixteen fluidounces, D.].—A most valuable preparation. A mild cathartic, tonic, antacid, and emmenagogue. Used

in the before-mentioned cases in doses of $f\bar{3}ss$ to $f\bar{3}ii$. Acids, acidulous salts, and most metallic salts, are incompatible with it. If it be desirable to conjoin chalybeates with it, either the *Potassæ Ferrico-Tartras* (see vol. i. p. 752) or the *Ammoniæ Ferrico-Citras* (see vol. i. p. 749) may be added to the cold decoction without undergoing decomposition. The quality of the aloes used, the length of time the decoction is boiled, and the purity of the extract of liquorice, affect the transparency or turbidity of this decoction, which is never so bright as tincture of aloes.¹

9. **EXTRACTUM ALOËS, L.**; *Extractum Aloës Purificatum*; *Purified Extract of Aloes*.—(Socotrine Aloes $\bar{3}xv$; Boiling Water Cong. j. Macerate for three days with a gentle heat; afterwards strain and set by, that the dregs may subside. Pour off the clear liquor, and evaporate it to a proper consistence.)—It is intended to deprive the aloes of the substance called resin, on which its irritating and griping qualities have been supposed to depend. Dose, five to fifteen grains.

β. **EXTRACTUM ALOËS BARBADENSIS, L.**; *Extract of Barbados Aloes*.—This is prepared in the same way as the *Extractum Aloës, L.*

γ. **EXTRACTUM ALOËS HEPATICÆ**; *Extractum Aloës Aquosum, D.*; *Extract of Hepatic Aloes*; *Watery Extract of Aloes*.—Hepatic Aloes, in coarse powder, $\bar{3}iv$; Water Oij. Boil the aloes until it is dissolved; when the solution is cold, and the dregs have subsided, pour off the clear liquid, and evaporate it to a proper consistence, *D.*

The effects, uses, and doses of these two preparations are the same as those of *Extractum Aloës*.

10. **TINCTURA ALOËS, L. E. [U. S.]**; *Tincture of Aloes*.—(Socotrine or Hepatic Aloes, coarsely powdered, $\bar{3}j$; Extract of Liquorice $\bar{3}iij$; Distilled Water Oiss [Oj and $f\bar{3}vij$, *E.*]; Rectified Spirit Oss [$f\bar{3}xij$, *E.*]. Macerate for seven [with occasional agitation, *E.*] days, and strain. This tincture cannot without difficulty and delay be prepared by percolation, *E.*)—Purgative and stomachic. Dose, $\bar{3}ij$ to $\bar{3}j$.

11. **TINCTURA ALOËS COMPOSITA, L.**; *Tinctura Aloës et Myrrhæ, E. [U. S.]*; *Elixir Proprietatis* of Paracelsus, *Compound Tincture of Aloes*.—(Socotrine or Hepatic Aloes, coarsely powdered, $\bar{3}iv$ [$\bar{3}iij$, *U. S.*]; Saffron $\bar{3}ij$ [$\bar{3}i$, *U. S.*]; Tincture of Myrrh Oij. Macerate for seven days, and strain, *L.* This tincture cannot be well prepared by percolation, *E.*)—Purgative, stomachic, emmenagogue. Used in cold, sluggish habits. Dose, $\bar{3}ss$ to $\bar{3}j$.

12. **VINUM ALOËS, L. E. [U. S.]**; *Tinctura Sacra*; *Wine of Aloes*.—(Socotrine or Hepatic Aloes, rubbed to powder, $\bar{3}ij$; Canella, powdered, $\bar{3}iv$; Sherry Wine Oij. Macerate for seven days, frequently shaking, and strain. The *Edinburgh College* uses Aloes [Socotrine or East Indian] $\bar{3}iss$; Cardamom seeds ground, Ginger in coarse powder, of each $\bar{3}iss$; Sherry Oij. Digest for seven days, and strain through linen or calico [Aloes, in powder, $\bar{3}i$; Cardamom bruised, Ginger bruised, of each a drachm; White Wine a pint. Macerate for fourteen days, with occasional agitation, and filter through paper, *U. S.*].—Wine of aloes is purgative in doses of $f\bar{3}ss$ to $f\bar{3}ij$; stomachic in doses of $f\bar{3}j$ to $f\bar{3}ij$.

Aloes is a constituent of several other preparations (as *Pilula Colocynthis composita, L. D.*; *Pilulæ Colocynthis, E.*; *Pilulæ Rhei compositæ, L. E.*; *Pilulæ Cambogiæ, E.*; *Pilulæ Cambogiæ compositæ, L.*; *Tinctura Rhei et Aloës, E.*), which will be described hereafter.

¹ *Pharmaceutical Journal*, vol. i. p. 182, 1841.

62. URGINEA SCILLA, *Steinheil*.—THE SEA ONION, OR OFFICIAL SQUILL.

Sex. Syst. Hexandria, Monogynia.

(*Bulbus recens*, L.—*Bulb*, E. D.)

SYNONYMES.—*Squilla maritima*, *Steinheil*;¹ *Scilla maritima*, *Linn.*; *Cepa marina*, *Lobel*.

HISTORY.—The Egyptians worshipped a bulbous plant called by *Lucian* Κρόμμυον, and which *Pauw*² asserts to be the squill, and further suggests that it was the red variety (? *Squilla Pancration* var. α *Bulbo rufo*, *Steinheil*); but by others it has been thought to be the onion (see *Allium Cepa*). *Pythagoras*³ is said to have written a volume on the medicinal properties of squill, and to have invented the *acetum scillæ*. *Hippocrates* employed squill (σκόλλα) internally,⁴ externally,⁵ and as a pessary.⁶ *Pliny*⁷ says there are two medicinal sorts of squills—one, which he calls the *male*, with white leaves; the other, or *female*, with black leaves: the former probably is white, the latter red squills.

BOTANY. *Gen. Char.*—*Sepals* three, coloured, spreading. *Petals* very like them, and scarcely broader. *Stamens* six, shorter than the perianth; *filaments* smooth, somewhat dilated at the base, acuminate, entire. *Ovary* three-parted, glandular and melliferous at the apex; *style* smooth, simple; *stigma* obscurely three-lobed, papillose. *Capsule* rounded, three-cornered, three-celled. *Seeds* numerous, in two rows, flattened with a membranous testa. (*Steinheil*.)

Sp. Char.—*Leaves* very large, subsequently spreading. *Bracts* long. *Flowers* white; flower-bud somewhat acute. *Anthers* yellow. *Ovarium* thick, yellowish. *Bulb* very large. (*Steinheil*.)

Bulb roundish-ovate, half above ground. The *leaves* appear after the flowers: they are broad, lanceolate, twelve to eighteen inches long. *Scape* about two feet high, terminated by a dense long raceme.

Hab.—Shores of the Mediterranean, viz.: Spain, France, Sicily, Africa, &c. *Navarino* has long been celebrated for its squills. In its native soil the plant flowers about August.

SQUILLA PANCRATION, *Steinh.* (Παγκράτιον, *Dioscorides*) is said by *Steinheil* to yield a small bulb of a reddish colour, found in commerce under the name of squill.

DESCRIPTION.—The fresh bulb (*bulbus recens*, L.; *radix recens*, offic.) is pyriform, of the size of the fist to that of a child's head, and is composed of thick, fleshy, smooth, shiny scales, attenuated at their edges, closely applied over each other, and attached to a conical disk (a rudimentary stem) which projects inferiorly, and gives origin to the root fibres, the remains of which are to be frequently found in the bulbs of commerce. The outer scales are usually dry, thin, coloured, membranous, or papery. By cracking the inner or fleshy scales, numerous spiral vessels may be drawn out. On submitting the cuticle of the scales to a microscopic examination, numerous acicular crystals (*raphides*) are perceived in cells, which are distinguished from the surrounding angular cells by being larger and elliptical. The *pulvis scillæ*, offic., contains nine or ten per cent. of these crystals.

Two kinds of squills, both abounding in an acrid juice, and having a very bitter taste, are met with in commerce; viz., the *white* (*scuilla alba*, *mascula*, vel *hispa-*

¹ In 1831, *Steinheil* (*Ann. Sc. Nat.* t. i. p. 321, 2nde Sér.) proposed the name *Urginea* for the genus to which squill (*Urginea Scilla*, *Steinh.*) belongs. Some objections having been raised to it, and no systematic writer having then adopted it, *Steinheil*, in 1836 (*op. cit.* t. vi. p. 272), proposed to substitute the name of *Squilla* (σκόλλα) for *Urginea*; but subsequently some writers have adopted the term *Urginea* as the generic name.

² *Phil. Diss. on the Egyptians and Chinese*, vol. i. p. 130, 1795.

³ *Pliny, Hist. Nat. lib. xix. cap. 30*, ed. Vulp.

⁴ *De ulceribus*.

⁵ *Hist. Nat. lib. xix. cap. 30*, ed. Vulp.

⁶ *De victūs ratione*.

⁷ *De Nat. Mul.*

nica), and the red (*scilla rubra*, *fæmina*, vel *italica*),¹ both of which are so called from the colour of the scales. The white is preferred in England.

In the London Pharmacopœia (1851) the fresh bulbs are directed to be dried like colchicum.

Dried squill (*radix scillæ siccata*, offic.) is, however, for the most part imported, in consequence of the duty being no higher for this than for the recent bulb. It occurs in white or yellowish-white, slightly diaphanous pieces, which, when dry, are brittle, but when moist are readily flexible. As their affinity for moisture is great, they should be preserved in well-stoppered bottles, or in a very dry place.

Squill is imported from Malta, and other countries of the Mediterranean. Also from Petersburg and Copenhagen.²

COMPOSITION.—The more recent analyses of squill are those of Vogel, in 1812,³ and of Tilloy, in 1826.⁴ Buchner,⁵ in 1811, examined the juice of the fresh bulb.

Vogel's Analysis of Squills, dried at 212° F.		Tilloy's Analysis of dried and fresh Squills.		Buchner's Analysis of fresh Squill bulb juice.	
Scillitin with some sugar . . .	35	Acrid bitter resinous extractive (<i>Scillitin</i>)	24	Peculiar bitter extractive . . .	9.47
Tannin	24	Uncrystallizable sugar. Gum.	6	Mucilage	3.00
Gum	6	Fatty matter.		Gelatinous matter (<i>Tra-</i> <i>gacanthin</i> ?)	0.94
Woody fibre, and some ci- trate (and perhaps tartrate) of lime	30	Piquant, very fugaceous matter.		Phosphate of lime	0.31
Acrid volatile matter				Fibrous matter	3.38
Loss	5			Water	79.01
				Astringent acid	traces
				Loss	4.40
Squill bulb	100	Squill bulb.		Squill juice	100.00

1. ACRID, VOLATILE? MATTER.—It is well known that squill, in the recent state, is very acrid, and, when applied to the skin, causes irritation, inflammation, and even vesication. By drying, the greater part of this acridity is got rid of; and hence the acrid principle is usually described as being of a volatile nature, and, in confirmation of its volatility, Athanasius⁶ states that two ounces of water distilled from fresh squills caused the death of a dog in six hours. However, by others, its volatility is denied; and Vogel says, that six ounces of water distilled from fresh squills had no effect on dogs. Buchner⁷ states, that besides the bitter scillitin, squill contains, according to his experiments, another principle, which is combined with phosphate of lime, and which is capable of exciting itching and inflammation. This acrid matter may be easily decomposed, but is not volatile, as is generally supposed.

2. SCILLITIN (*Scillitine*, Thomson).—The substance to which Vogel gave the name of Scillitin is a whitish transparent deliquescent substance, which, when dry, has a resinous fracture, and may be easily rubbed to powder. Its taste is bitter, and subsequently sweetish. It readily dissolves in water, spirit of wine, and acetic acid. The substance sold in the shops under the name of Scillitin is a thick treacle-like liquid. Landerer⁸ obtained crystals of Scillitin. He says they possessed alkaline properties. Lebordais,⁹ on the other hand, says it is neutral and incrySTALLIZABLE. It obviously requires further examination.

3. RAPHIDES (*Phosphate of lime?* *Oxalate of lime?*).—The acicular crystals found in the cuticle of the scales of the bulb, as before mentioned, probably consist of phosphate of lime, or, according to Schleiden, of oxalate of lime. These, perhaps, are the needle-like crystals obtained by Vogel by evaporating the juice of the bulb, and which he regarded as citrate of lime. According to the late Mr. E. Quekett they constitute about 10 per cent. of powdered squills.

CHEMICAL CHARACTERISTICS.—An aqueous decoction of squills is pale, and very bitter. Sesquichloride of iron communicates an intense purplish blue colour (*gallate of iron*) to it. (This test I have not found to succeed uniformly. The decoction of some specimens of squills scarcely becomes altered by the salts of iron.) Gelatin has scarcely any effect on it. Nitrate of silver forms a white precipitate (*chloride of silver*) soluble in ammonia, but insoluble in nitric acid. Oxalate of ammonia renders the decoction turbid, and after some time causes a white precipitate (*oxalate of lime*). Diacetate of lead and proto-nitrate of mercury form pre-

¹ Is the red kind the *Squilla Pancration* var. *a. Bulbo Rufo*. Steinheil?

² *Trade List*, Sept. 11, and Nov. 20, 1838. Sir James Wylie (*Pharm. Castren. Ruthenica*, p. 335, ed. 4to. 1840) gives North Russia as one of the habitats of this plant.

³ *Ann. de Chim.* t. 83, p. 147.

⁴ *Berl. Jahrb.* xv. p. 1.

⁵ Pfaff, *Mat. Med.* Bd. v. S. 18.

⁶ Thomson's *Org. Chem.* p. 717.

⁷ *Journ. de Pharm.* xii. p. 635.

⁸ *Toxicologie*, 340.

⁹ *Ann. de Chim. et de Phys.* xxiv. 52.

cupitates in the decoction. Tincture of nutgalls has little or no effect on it; it sometimes occasions a cloudiness. Starch is not recognizable in it by iodine. Alkalies heighten the colour of the decoction.

An infusion of squills in water acidulated with hydrochloric acid yields a white precipitate with oxalate of ammonia (*oxalate of lime*); and with caustic ammonia sometimes a precipitate (*phosphate of lime*), at others scarcely a cloud.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Not ascertained.

β. On Animals.—An ounce of powdered squills acts as a diuretic on horses and other large animals; the same effect is produced on smaller animals by half a drachm.¹ When the dose is large, squill acts as a poison. It first causes local irritation; then its active principle becomes absorbed, affects the nervous system, and thereby quickens the respiration, causes convulsions, and death.² Hillefeld³ mentions paralysis produced in a rabbit by nineteen grains of powdered squill. Emmert and Hoering⁴ state that the squill juice introduced into the abdominal cavity became absorbed.

γ. On Man.—Squill is an acrid. In small doses it acts as a stimulant to the excretory organs. Thus it promotes secretion from the mucous membranes (especially the bronchial and gastro-intestinal) and the kidneys. Its most marked effect is that of a diuretic. Its expectorant effects are less obvious and constant. Sometimes, when it fails to act on the kidneys, it increases cutaneous exhalation. Its influence on secreting organs is probably to be referred to the local stimulus communicated to their vessels by the active principle of squill in its passage out of the system, for Emmert and Hoering⁵ have shown that the juice is absorbed, so that squills may be regarded as an acrid even for these remote parts. When it proves diuretic in dropsies, it usually promotes the absorption of the effused fluid—an effect which is, I think, indirect, and a consequence of the diuresis. But Sundelin⁶ observes of squill, that it promotes the secretion of urine less by its local irritation of the kidneys, than by its general excitement of the absorbent apparatus.

By the continued use of squill, in gradually increased doses, it disturbs the functions of digestion and assimilation.

In full medicinal doses, squill excites nausea and vomiting. Purging, also, is not unfrequently produced. When squill proves emetic or purgative, its diuretic operation is much less obvious—a circumstance which Cullen⁷ refers to the squill being prevented reaching the blood-vessels and kidneys. Home,⁸ however, alleges that the diuretic effects are not to be expected unless there be some operation on the stomach. But the operation on the stomach may be, as Cullen suggests, a mere test of the activity of the squills. However, that the effect of squill, in strong doses, is not confined to the alimentary canal, is proved by the fact, that when the vomiting and purging were present, the pulse has been observed to be reduced in frequency, often to forty beats per minute (Home).

In excessive doses, squill acts as a narcotico-acrid poison, and causes vomiting, purging, griping pain, strangury, bloody urine, convulsions, inflammation, and gangrene of the stomach and intestines.⁹ Twenty-four grains of the powder have proved fatal.¹⁰

Considered with reference to its diuretic effect, squill is comparable with foxglove. But it exceeds the latter in its stimulant influence over the urinary organs. On the other hand, foxglove is characterized by its powerfully sedative effect on the vascular system; for though squill has, in some instances, reduced the frequency of the pulse, this effect is by no means common. Squill, says Vogt,¹¹ preponderates in its action on the inferior or vegetative [organic] life; foxglove, on the other hand, in its action on the higher or animal life.

¹ Moiroud, *Pharm. Vétér.*

² Marx, *Die Lehre von d. Giften*, vol. ii.

³ *Op. cit.*

⁴ *Treat. of the Mat. Med.* p. 557.

⁵ Murray, *App. Med.* vol. v. p. 97.

⁶ *Pharmakodyn.* ii. 343, 2te Aufl.

⁷ Orfila, *Toxicol. Gén.*

⁸ Meckel's *Archiv*, B. 4, Heft 4, S. 527.

⁹ *Handb. d. sp. Heilm.* Bd. ii. S. 17.

¹⁰ *Clinical Experiments*, 3d edit. p. 387, 1783.

¹¹ Vogel, *Journ. de Phys.* lxxv. 194.

USES.—The principal uses of squill are those of an emetic, diuretic, and expectorant.

1. *As a diuretic in dropsies.*—It is applicable to those cases of dropsy requiring the use of stimulating or acrid diuretics, and is improper in inflammatory cases. It is an unfit remedy for dropsy complicated with granular kidney or vesical irritation; but when these conditions are not present, it is adapted for torpid leucophlegmatic subjects. Hence, it is more serviceable in anasarca than in either ascites or hydrothorax. It should be given so as to excite a slight degree of nausea (not vomiting), as recommended by Van Swieten.¹ By this means its absorption is promoted. The acetate or bitartrate of potash may be conjoined. Calomel is usually regarded as a good adjunct for promoting the diuretic influence of squill. When it does not purge it is beneficial, but its tendency to affect the bowels is an objection to its use.

2. *As an expectorant in chronic pulmonary affections* admitting of the use of a substance stimulating the capillary vessels of the bronchial membrane. Thus, in chronic catarrh, humid asthma, and winter cough, it is often employed with considerable benefit. It is of course improper in all acute cases accompanied with inflammation or febrile disorder. In old persons it is often combined with the *tinctura camphoræ composita*, and with good effect. The oxymel or syrup of squill may be given to relieve troublesome chronic coughs in children.

3. *As an emetic*, it is occasionally used in affections of the organs of respiration requiring or admitting of the use of vomits. Thus, the oxymel is given, with the view of creating sickness and promoting expectoration, to children affected with whooping-cough; and sometimes, though with less propriety, in mild cases of croup. The great objection to its use is the uncertainty of its operation: in one case it will hardly excite nausea, in another it causes violent vomiting. Furthermore, it is of course highly objectionable as an emetic for delicate children with irritable stomachs, on account of its acrid properties, and the irritation it is capable, in these cases, of setting up.

ADMINISTRATION.—The following are the preparations of squills usually employed:—

1. *PULVIS SCILLÆ; Powder of Squill.*—The bulb loses about four-fifths of its weight by drying; so that six grains of the dry powder are equal to half a drachm when fresh. Powdered squill readily attracts water from the atmosphere, and becomes soft and mouldy; hence the necessity of preserving it in stoppered bottles and in a dry place. I have seen it become hard and massive like diachylon plaster. It is usually administered in the form of pill. The dose of the powder, as an emetic, is from six to fifteen grains; ten grains being the average. As an expectorant or diuretic we should commence with one grain, and gradually increase the dose until slight nausea is excited.

2. *PILULA SCILLÆ COMPOSITÆ, L.; Pilulæ Scillæ Compositæ, D. [U. S.]; Pilulæ Scillæ, E.; Compound Squill Pill.*—(Squill, fresh dried and powdered, ℥i [℥iiss, D.]; Ginger powdered, Ammoniacum powdered, of each ℥ij; Soft Soap ℥iij [Castile Soap ℥ij, D.] [Syrup, U. S.]; Treacle as much as may be sufficient [by weight ℥ss, D.]. Mix the powders together; then beat them with the other ingredients until they are incorporated. The *Edinburgh College* takes of powdered Squill *five parts*; powdered Ammoniac, Ginger, and Spanish Soap, of each *four parts*; Conserve of Red Roses *two parts*; and forms them into five-grain pills.)—Expectorant and diuretic. Principally used in chronic bronchial affections. Dose, from five to twenty grains. It readily spoils by keeping.

3. *TINCTURA SCILLÆ, L. D. E. [U. S.]; Tincture of Squills.*—(Squill, fresh dried [in coarse powder, E.], ℥v; Proof Spirit Oij; macerate for seven [fourteen, D.] days, and strain, L. “Prepare this tincture by percolation, as directed for

¹ *Commentary upon Boerhaave's Aphorisms*, vol. xii. p. 435.

tincture of cinchona, but without packing the pulp firmly in the percolator. It may likewise be obtained by the process of digestion from the sliced bulb." *E.*) [The *U. S. Pharm.* directs of Squill four ounces; diluted Alcohol two pints; macerate for fourteen days, compress and filter through paper; or, this tincture may also be prepared by thoroughly moistening the Squill in powder, with diluted Alcohol, allowing it to stand for twenty-four hours, then transferring to an apparatus for displacement, and gradually pouring upon it diluted Alcohol, until two pints of the filtered liquor are obtained.]—Expectorant and diuretic. Used in chronic bronchial affections. Dose, m_x to $\text{f}\text{3ss}$.

4. *ACETUM SCILLÆ*, L. D. E. [*U. S.*]; *Vinegar of Squills*.—(Squill, fresh dried and powdered, 3ijss [3ij , *D.*]; Dilute Acetic Acid Oj [Acetic Acid of commerce (sp. gr. 1.044), $\text{f}\text{3iv}$; Distilled Water 3xij , *D.*]; [Proof Spirit $\text{f}\text{3iss}$, *L.*] The ingredients and relative proportions used by the Edinburgh College are the same as those of the London College, except that distilled vinegar is employed. Macerate the squill with the vinegar, with a gentle heat, in a covered vessel, for three [seven, *D. Ed.*] days; afterwards press out [the liquor] and set it aside, that the dregs may subside; lastly, add the spirit to the clear liquor. [The *U. S. Pharm.* directs, of Squill, bruised, four ounces; Diluted Acetic Acid two pints; Alcohol a fluidounce. The process is the same as that of the Dublin College; or it may be made by displacement.]—Expectorant and diuretic. Used in chronic pulmonary affections and dropsies, under the regulations before described. Dose, 3ss to 3iss , in some aromatic water.

5. *OXYMEL SCILLÆ*, L. [*U. S.*]; *Syrupus Scillæ*, *E.*; *Oxymel of Squills*; *Syrup of Squills*.—(Honey ℥ij ; Vinegar of Squill Oijss . Boil down the vinegar, with a slow fire, to twelve fluidounces, and mix the honey, made hot, *L.*—Vinegar of Squills Oij ; Pure Sugar ℥vij . Dissolve the sugar in the vinegar of squills with the aid of a gentle heat and agitation, *E.*) [Vinegar of Squill Oij ; Clarified Honey Ojss . Mix them, and evaporate, by means of a water-bath, to the proper consistence. The specific gravity should be 1.32, *U. S.*]—Used as an expectorant in chronic catarrhs and asthma, in doses of $\text{f}\text{3j}$ or $\text{f}\text{3ij}$. As an emetic, it is sometimes given to children affected with whooping-cough or croup, in doses of a teaspoonful repeated every quarter of an hour until vomiting occurs.

6. *SYRUPUS SCILLÆ*, *U. S.*; *Syrup of Squills*.—This is directed to be prepared of Vinegar of Squills a pint; Sugar two pounds. Add the sugar to the vinegar of squill, and proceed in the manner directed for syrup. This preparation is used in place of the preceding as an emetic and expectorant. In affections of the lungs, where squill is beneficial, it may be employed as an ingredient of cough mixtures, variously compounded. As a common remedy for children in cases of cough or cold, it is with safety directed and commonly used. The dose is $\text{f}\text{3ss}$ to 3j or 3ij .

7. *SYRUPUS SCILLÆ COMPOSITUS*, *U. S.*; *Compound Syrup of Squill*; *Hive Syrup*.—Take of Squill bruised, Senega bruised, each four ounces; Tartrate of Antimony and Potassa forty-eight grains; Water four pints; Sugar three pounds and a half. Pour the water upon the squill and senega, and having boiled to one-half, strain, and add the sugar; then evaporate to three pints, and, while the syrup is still hot, dissolve in it the tartrate of antimony and potassa. Another mode of preparation is, to take of Squill in coarse powder, Senega in coarse powder, each four ounces; Tartrate of Antimony and Potassa forty-eight grains; Alcohol half a pint; Water a sufficient quantity; Sugar three pounds and a half. Mix the alcohol with two pints and a half of water, and macerate the squill and senega in the mixture for twenty-four hours. Put the whole in an apparatus for displacement, and add as much water as may be necessary to make the filtered liquor amount to three pints. Boil the liquor for a few minutes, evaporate to one-half, and strain; then add the sugar, and evaporate until the resulting syrup measures three pints. Lastly, dissolve the tartrate of antimony and potassa in the syrup, while it is still hot.

This preparation is a modification of that made according to the formula given

by Dr. J. R. Coxe, and which goes by the name of *Coxe's Hive Syrup*. In the former editions of the Pharmacopœia, the formula of Dr. Coxe was adopted; and as honey was substituted for sugar, it had the officinal name of *Mel Scillæ compositum*. The formula above cited authorizes the substitution of sugar for honey, as it is less liable, when prepared as directed, to undergo fermentation—a great desideratum in hot weather. There is no difference between the proportions of the ingredients, so that an equal strength of the two preparations is obtained by both. The latter was introduced in accordance with the recommendation of the Committee of Revision of the Philadelphia College of Pharmacy.

This preparation combines the advantages of squill, senega, and tartarized antimony, and is an exceedingly active preparation. In sufficient doses, it operates upon the stomach, producing free vomiting and expectoration. It is used at the commencement of croup, whooping-cough, and catarrhal affections in children, with the view to its evacuant impression. In the inflammatory stages, as an expectorant and nauseant, it may also be employed with advantage, in reduced doses. The dose is from gtt. x to fʒi, according to the age of the child, repeated every ten or fifteen minutes until it pukes. As an expectorant for adults, the dose is gtt. xx to gtt. xxx.]

ANTIDOTE.—No antidote is known. The first object, therefore, in a case of poisoning, is to evacuate the stomach; the second, to allay the inflammatory symptoms which may supervene.

63. ALLIUM SATIVUM, Linn.—COMMON OR CULTIVATED GARLIC.

Sex. Syst. Hexandria, Monogynia.

(Bulb, E.)

HISTORY.—This plant was well known to the ancients. The Greeks called it *σκόροδον*;¹ the Romans *Allium*.² It was used by Hippocrates.³

BOTANY. Gen. Char.—*Flowers* umbellate, with a membranous *spathe*. *Perianth* six-parted, permanent, equal. *Stamens* inserted into the base of the perianth; *filaments* either all alike, or every other one tricuspidate, with the *anther* on the middle point. *Style* subulate, *stigma* simple. *Capsule* usually obtusely three-cornered or three-lobed, depressed, three-celled, bursting into three valves through the dissepiments, and containing two or one black angular seed in each cell. (Lindley.)

Sp. Char.—*Bulb* surrounded by smaller ones. *Leaves* linear, entire. *Umbel* bulbiferous, globose. *Spathe* ovate, rounded. *Segments of the perianth* ovate, obtuse. *Pistil* and *stamens* exsert.⁴ *Stem* about two feet high. *Flowers* whitish.

Hab.—?South of Europe. ?Egypt. ?Persia. Cultivated in kitchen gardens. It flowers in July.

DESCRIPTION.—The *bulb* (*bulbus allii*) is composed of *cloves* (*spicæ vel nuclei allii*), each furnished with its proper envelopes. Its odour is strong, irritating, and characteristic; its taste is acrid.

COMPOSITION.—Cadet⁵ analyzed garlic. He found the constituents to be *acrid volatile oil*, *extractive* (a little), *gum*, *woody fibre*, *albumen*, and *water*. The ashes contained alkaline and earthy salts. Bouillon-Lagrange has detected, besides these, *sulphur*, *starch*, and *saccharine matter*.⁶

OIL OF GARLIC (*Oleum Allii*) is a sulphuret of allyle, $\text{AllS}=\text{C}^6\text{H}^5\text{S}$ (see vol. i. p. 253). According to Wertheim,⁷ oxide of allyle, $\text{AllO}=\text{C}^6\text{H}^5\text{O}$, also exists in the crude oil. Oil of garlic has a very acrid taste, a strong smell, and a yellow colour. It is heavier than water, and is soluble in alcohol. As it contains sulphur it produces, in burning, sulphurous acid. According to Cadet, 20 lbs. of garlic yielded only six drachms of essential oil; Wertheim obtained between

¹ Theophrastus, *Hist. Plant.* lib. vii. cap. iv.; Dioscorides, lib. ii. cap. 182.

² Pliny, *Hist. Nat.* lib. xix. cap. 31, ed. Valp.

³ De Candolle, *Bot. Gall.*

⁴ *Journ. de Pharm.* t. ii. p. 358.

⁵ *Ann. d. Chem. u. Pharm.* Bd. li. S. 289, 1844; *Pharmaceutical Journal*, vol. iv. p. 325, 1845.

⁶ *De victus ratione in acutis*, p. 404, ed. Fæsi.

⁷ Gmelin, *Handb. d. Chem.* ii. 1336.

three and four ounces from 1 cwt. of garlic. It strikes a black colour when rubbed with oxide of iron. It is a powerful irritant, and when applied to the skin causes irritation. The Hindoos, according to Dr. Ainslie,¹ prepare a stimulating expressed oil from garlic, which they give internally in ague, and use externally in palsy and rheumatism.

PHYSIOLOGICAL EFFECTS.—Garlic is a local irritant. When swallowed, it operates as a tonic and stimulant to the stomach. Its volatile oil becomes absorbed, quickens the circulation, occasions thirst, and is thrown out of the system by the different excretories, the activity of which it promotes, and to whose excretions it communicates its well-known odour. Large doses occasion nausea, vomiting, and purging. Puihn² says the expressed juice has proved fatal.

USES.—Employed by the cook as a flavouring ingredient in various made-dishes, sauces, &c. Rarely used by the medical practitioner. Internally, it has been exhibited as a stimulant and stomachic in enfeebled digestion; as an expectorant in old chronic catarrhs; as a diuretic in atonic dropsies; and as an anthelmintic. Externally, it has been employed as a resolvent in indolent tumours; as a local irritant or rubefacient applied to the feet to cause revulsion from the head or chest; as an antispasmodic liniment (composed of oil and garlic juice) in infantile convulsions; as a remedy for some cases of deafness, a clove or a few drops of the juice being introduced into the ear.

ADMINISTRATION.—A clove may be swallowed either entire, or, more conveniently, cut into small pieces. The dose of the fresh bulbs is one or two drachms. The expressed juice mixed with sugar, the infusion of garlic, and a syrup, are sometimes employed.

[SYRUPUS ALLII.]—Take of fresh Garlic, sliced, six ounces; diluted Acetic Acid a pint; Sugar two pounds. Macerate the garlic in the diluted acetic acid in a glass vessel for four days, then express the liquor, and set it by that the dregs may subside. Add the sugar to the clear liquor, and proceed in the manner directed for syrup.

This formula was adopted upon the recommendation of Mr. Daniel B. Smith, of Philadelphia, who demonstrated the futility of the old method of preparing syrup of garlic, of which formula (*Journal of Philadelphia College of Pharmacy*, No. 1, p. 50) it is a modification. Dose, ʒi.]

64. ALLIUM CEPA, Linn.—THE ONION.

Sex. Syst. Hexandria, Monogynia.
(Bulbus.)

HISTORY.—The onion was known and used in the most ancient times. By Fraas³ it is considered to be the *κρόμμυον* (see *ante*, p. 207) of Theophrastus⁴ and Dioscorides.⁵ The *σκράνον* of Theophrastus was a variety of onion. By Pliny⁶ the onion is called *cepa*. It was employed in medicine by Hippocrates. An onion taken from the hand of an Egyptian mummy perhaps 2000 years old has been made to grow.⁷

BOTANY. Gen. Char.—Vide *Allium sativum*.

Sp. Char.—*Stem* fistulous, ventricose beneath; longer than the terete, fistulous leaves. *Umbel* capsuliferous, globose. *Segments of perianth* linear-elliptic, obtuse; shorter than the stamens and pistil.⁸ *Biennial*. *Flowers* whitish. *July*.

Loudon⁹ enumerates eighteen varieties deserving of culture.

Hab.—Egypt. Cultivated in kitchen gardens.

Besides *A. sativum* and *A. Cepa*, various other species of *Allium* are also cultivated for culinary purposes; as, *A. Porrum*, the Leek; *A. ascalonicum*, the Shallot; *A. Schanoprasum*, the Chive; and *A. Scorodoprasum* or Rocambole. Their virtues are analogous to those of the onion and garlic.

¹ *Materia Indica*, i. 151.

² *Synops. Plant. Fl. Class.* p. 291, 1845.

³ *Lab.* ii. cap. 151.

⁴ *Möller's Physiol.* by Baly, vol. i. p. 29.

⁵ *Encyclopædia of Gardening*.

⁶ Quoted by Wibmer, *Die Wirk. d. Arzneim.*

⁷ *Hist. Plant.* lib. vii. cap. 4.

⁸ *Hist. Nat.* lib. xix. cap. 32, ed. Valp.

⁹ *Botanicon Gallicum*.

DESCRIPTION.—The bulb (*bulbus*) is tunicated. When cut, it evolves an acrid principle, having a well-known odour, and a powerful action on the eyes, causing a flow of tears. Its taste is sweet and acrid. *Onion juice* is colourless, but by exposure to the air it becomes reddish.

COMPOSITION.—According to Foureroy and Vauquelin,¹ the onion contains an *acrid volatile oil*, *uncrystallizable sugar*, *gum*, *woody fibre*, *albumen*, *acetic* and *phosphoric acids*, *phosphate* and *citrate of lime*, and *water*.

OIL OF ONIONS (*Oleum cepæ*) contains sulphur, and is probably similar in composition to oil of garlic, $\text{AlHS}=\text{C}^2\text{H}^5\text{S}$. It is acrid, piquant, and colourless.

PHYSIOLOGICAL EFFECTS.—Analogous to those of garlic, but milder. The oil becomes absorbed, and communicates the well-known onion odour to the breath. By boiling onions the volatile oil is dissipated, and the bulb is deprived of its irritating qualities, and becomes a mild esculent substance.

USES.—Extensively used as an article of food and as a condiment. It is very rarely employed in medicine, but is adapted to the same cases as garlic. Raw onions are occasionally taken as an expectorant, with advantage, by elderly persons affected with winter cough.

ADMINISTRATION.—A roasted onion is sometimes employed as an emollient poultice to suppurating tumours, or to the ear to relieve ear-ache. The expressed juice has been given to children, mixed with sugar, as an expectorant.

65. *Asparagus officinalis*, Linn.—Common Asparagus.

Sex. Syst. Hexandria, Monogynia.

(Turiones et Radix.)

A well-known indigenous culinary vegetable, which is extensively cultivated in gardens for its young succulent shoots (*turiones asparagi*), which, when boiled, form a much admired article of food. These, as well as the root (*radix asparagi*), have been used in medicine.

The shoots have been chemically examined by Robiquet,² who found in their juice *asparagin*, *mannite*, *peculiar aqueous extractive*, *green acrid oleo-resinous matter*, *wax*, *gluten*, *albumen*, *colouring matter*, and *salts of potash and lime*.

Dulong³ analyzed the root, and found in it *albumen*, *gum*, a *peculiar matter* (precipitable by basic acetate of lead and protonitrate of mercury), *resin*, *saccharine matter* (reddened by oil of vitriol), and *salts of potash and lime*. He detected neither asparagin nor mannite.

Asparagin (also called *asparamid*, *althain*, and *agédail*) crystallizes in right rhombic prisms,⁴ whose formula is $\text{C}^8\text{H}^8\text{N}^2\text{O}^6+2\text{HO}$). When heated to 248°F ., they lose 12 per cent. of water. They have a cooling, somewhat nauseous taste, are slightly soluble in cold water, more so in boiling water, but are insoluble in alcohol and ether. By the action of acids and alkalis aided by heat asparagin is resolved into *aspartic acid*, $\text{C}^8\text{H}^8\text{NO}^6$, and ammonia, NH^3 . Asparagin is found in the urine of those who have swallowed it (see *ante*, p. 279).

The young shoots act as diuretics, and communicate a peculiar fetid odour⁵ to the urine. This is produced neither by the asparagin nor by the volatile matter contained in the distilled water of the shoots, but by something which resides in the aqueous extract.⁶ Formerly, an emmenagogue and aphrodisiac property was ascribed to asparagus.

The medicinal properties of the root are similar to those of the shoots. Like the latter, it communicates an unpleasant odour to the urine. It formed one of the *five greater aperient roots* (*radices quinque aperientes majores*) which were formerly used in visceral diseases. The other four were butcher's broom (*Ruscus aruleatus*), celery or smallage (*Apium graveolens*), parsley (*Petroselinum sativum*), and fennel (*Feniculum officinale*).

Though no longer contained in our Pharmacopœia, asparagus is still occasionally used as a popular remedy, chiefly as a diuretic in dropsies, and as a lithic.⁷ For these purposes the shoots are boiled and used at table; or the root, which is considered superior to the shoots, is taken in the form of an infusion or decoction (prepared by boiling an ounce of the root in a quart of water), which may be taken as a common drink.

¹ *Ann. Chim.* lxx. 161, 1808.

² *Ann. de Chim.* lv. 152; also, Thomson's *Chemistry of Organic Bodies—Vegetables*, 1838.

³ *Journ. de Pharm.* t. xii. p. 278, 1826.

⁴ *Mr. C. Brooke, Pharm. Journ.* vol. vi. p. 560, 1847.

⁵ Murray (*App. Med.* vol. v. p. 194, 1790) thinks the odour not dissimilar to that of *Geranium robertianum*.

⁶ Plisson et Henry fils, in *Journ. de Pharm.* xvi. 725, 1830.

⁷ For some experiments on the solvent power of asparagus-juice for urinary calculi, see Lobb's *Treatise on Dissolvents of the Stone*, 1739.

66. *Polygonatum vulgare*, Desf.—Solomon's Seal.

Sex. Syst. Hexandria, Monogynia.
(Rhizoma.)

Convallaria Polygonatum, Linn.—A well-known indigenous plant, whose rhizome (*radix polygonati*), though long banished from the Pharmacopœia, is still kept in the herb shops, and sold as *Solomon's Seal* (*Sigillum Salomonis*). I suspect that the rhizome of *P. multiflorum* is also sold under the same name. When neither species is to be obtained, bryony root is commonly substituted.

Solomon's seal is a white, fleshy, odourless rhizome, having a sweetish, mucilaginous, very slightly bitterish, acrid taste. Iodine applied to the fresh cut surface of the rhizome gathered in September does not darken it. In these properties, the rhizomes of both the above-mentioned species of *Polygonatum* agree. Walz¹ examined chemically the herb, stem, and root of *P. multiflorum*. He found in them asparagin, uncrystallized sugar, starch, gum, gluten, peculiar nitrogenous matter, acrid resin, pectin, malic, citric, hydrochloric, and phosphoric acids, potash, magnesia, lime, and alumina.

Solomon's seal is a popular application to bruised parts (the eye, for example), to remove the marks. For this purpose it is scraped and applied to the parts. Gerarde² says it "taketh away in one night, or two at most, any bruse, blacke or blew spots gotten by falls or women's wilfulness, in stumbling upon their hastie husbands' fists."

67. *Dracæna Draco*, Linn.

Sex. Syst. Hexandria, Monogynia.

This tree, which has the habit of a palm, is a native of the Canary Islands. Its stem yields by incision a red juice, which concretes and forms a red resin resembling *dragon's blood* (see *ante*, p. 169), which appears to have been collected by the Spaniards when they took possession of those islands. Hence this species has usually passed for one of the sources of dragon's blood. But none of the commercial article is obtained from it. Indeed, Guibourt³ states that, at the present time, it is impossible to obtain the smallest quantity of it at the Canary Islands.

One of the *Dracæna*-trees growing at Orotava has long been celebrated for its great size and age; and next to the Baobab trees (*Adansonia digitata*), it is regarded as one of the oldest inhabitants of the earth.⁴

68. *Xanthorrhœa*, Smilh.

Sex. Syst. Hexandria, Monogynia.
(Resina.)

The *Xanthorrhœas* or *Grass-Trees* of Australia differ considerably in habit from the other Liliaceæ. Their stems are usually shrubby and resiniferous; their leaves long, narrow, grass-like, and in tufts; and their flowers small, white, and densely crowded on long cylindrical spikes like those of bulrushes (*Typha*). Mr. Brown⁵ has described seven species, viz., *X. arborea*, *australis*, *Hostile*, *media*, *minor*, *bracteata*, and *Pumilio*. The first two are arborescent, the third and fourth have short stems, and the last three are stemless.

Two resins, both the produce of this genus, have been imported into this country—one yellow, the other red.

1. The *yellow resin* of *Xanthorrhœa*, known by the various names of *yellow resin* of *New Holland* (*resina lutea novi Belgii*), *Botany Bay resin*, and *acaroid resin* or *gum* (*resina vel gummi acaroides*), was first noticed by Governor Phillips,⁶ in 1789.

It is obtained from the trunk of one or more species⁷ of *Xanthorrhœa* by spontaneous exudation.⁸ It occurs in more or less rounded tears; in flattened pieces, bearing on one side an im-

¹ *Jahrb. f. pr. Pharm.* vi. 15; vii. 17. (Wittstein's *Vollstand. etym. chem. Handwörterbuch*, Bd. i. S. 360, 1847.)

² *Herball*, 1633.

³ *Hist. Nat. des Drogues*, 4ème édit. t. ii. p. 145.

⁴ Humboldt, *Tabl. de la Nature*.—See, also, *Ann. des. Scien. Nat.* t. xiv. p. 137.

⁵ *Prodromus Floræ Novæ Hollandiæ*, 1810. One of the arborescent species (probably *X. arborea*) is called *black boy* (Drummond, in Hooker's *Journal of Botany*, vol. ii. p. 344, 1840).

⁶ *Voyage to Botany Bay*, 1789.

⁷ Smith (Rees's *Cyclop.* vol. xxxix. art. *Xanthorrhœa*) refers it to *X. Hostile* and some other species (see, also, Bennett's *Wanderings in New South Wales*, &c. 1834). On the other hand, L. Gmelin (*Handb. d. Chem.* ii. 618), on the authority of Sieber, and Mérat and De Lens (*Dict. Mat. Méd.* vi. 970, 1834); on the verbal authority of Mr. R. Brown, refer it to *X. arborea*.

⁸ White, *Journal of a Voyage to New South Wales*, in 1787, p. 235, 1790.

pression of the stems to which they were attached, and intermixed with portions of wood, stalks, earth, &c.; and in masses of variable size and irregular shape, having, when fractured, a speckled or granitic character. The pure resin is reddish-yellow. Its fresh fractured surface resembles that of gamboge; its powder is greenish-yellow. When heated, it emits a vapour having a fragrant odour like that of Tolu or storax. It has been repeatedly subjected to chemical examination; viz., by Lichtenstein,¹ Schrader,² Laugier,³ Widmann,⁴ Trommsdorff,⁵ and more recently by Stenhouse.⁶ It consists essentially of resin, cinnamic acid, a small quantity of benzoic acid, and a trace of volatile oil. Some samples contain a small quantity of bassorine. Heated with peroxide of manganese and oil of vitriol, it evolves the odour of the oil of bitter almonds. Its alcoholic solution yields, on the addition of water, a yellow precipitate soluble in caustic potash. By the action of nitric acid it yields so large a portion of carbazotic acid that it is likely to prove the best source of that acid. As it sometimes resembles Tolu and storax in composition, so it probably resembles them also in its medicinal properties. Mr. Kite⁷ employed it in several diseases. He says it neither vomits, purges, nor binds the belly; nor does it act materially as a diuretic or diaphoretic. More recently, Dr. Fish⁸ has employed it in the form of tincture with opium in *fluxus hepaticus*, and the colliquative diarrhœa of phthisis. On account of its resemblance in composition to the balsams, it deserves a trial in chronic catarrhs. A tincture of New Holland resin is prepared by digesting the resin in rectified spirit: Kite used equal parts of resin and spirit; Fish, 2 ounces of resin to 1½ of spirit. The dose of the tincture is ʒj or ʒij in milk or mucilaginous mixture.—It might be used as a substitute for, or mixed with other substances in the preparation of fumigating pastiles.

2. The red resin of *Xanthorrhœa* is sometimes imported under the name of black-boy gum. In colour it somewhat resembles dragon's blood, or Botany Bay kino (*Eucalyptus resinifer*); but many of the pieces, like some of those of the yellow resin of *Xanthorrhœa*, are marked by the impression of the trunk to which they have adhered. When heated, it evolves a fragrant balsamic odour; and, with the exception of the intermixed and adherent ligneous matters, is completely soluble in rectified spirit. The source of this resin would appear to be *X. Hastile*, for Viquet (quoted by Nees Von Esenbeck⁹) says that this species yields a red resin which resembles dragon's blood.

††† Flowers with a true perianth adherent to the ovary (*inferior ovary*), usually hermaphrodite.

ORDER XII. IRIDACEÆ, Lindl.—IRIDS, OR CORN-FLAGS.

IRIDEE, Juss.

CHARACTERS.—*Calyx* and *corolla* superior, confounded, their divisions partially cohering, or entirely separate, sometimes irregular, the three petals being occasionally very short. *Stamens* 3, arising from the base of the sepals; *filaments* distinct or connate; *anthers* bursting externally lengthwise, fixed by their base, 2-celled. *Ovary* 3-celled, cells many-seeded; *style* 1; *stigmas* 3, often petaloid, sometimes 2-lipped. *Capsule* 3-celled, 3-valved, with a loculicidal dehiscence. *Seeds* attached to the inner angle of the cell, sometimes to a central column, becoming loose; *albumen* horny, or densely fleshy; *embryo* enclosed within it.—*Herbaceous* plants, or very seldom *under-shrubs*, usually smooth; the hairs, if any, simple. *Roots* tuberous or fibrous. *Leaves* equitant, and distichous in most genera. *Inflorescence* terminal, in spikes, corymbs, or panicles, or crowded, sometimes radical. *Bracts* spatheaceous, the partial ones often scarious; the *sepals* occasionally rather herbaceous (*Lindley*).

PROPERTIES.—The underground stems and roots usually abound in fecula and mucilage; but these nutritive substances are generally combined with an acrid principle, which excludes their employment as articles of food. However, *Morœa edulis*, *M. sisyrinchium*, *Gladiolus edulis*, and a species of *Tigridia*, have been used as esculent substances. The rhizomes of several species of *Iris* (as *I. Pseudo-acorus*, *I. germanica*, *I. sibirica*, and *I. versicolor*) are remarkable, especially in the fresh state, for their acidity, in consequence of which some of them have been used as purgatives, sialagogues, or erlignes, or for issue-peas. The rhizomes of some species (as *I. florentina* and *I. germanica*) have an agreeable smell. The colour and the odour of saffron are to be regarded as part of the petaloid qualities of the stigmata of *Crocus*. The effects of this medicine on the nervous system are regarded by De Candolle¹⁰ as similar to those of [certain odorous] flowers.

¹ Crell's *Journal*, ii. 242, 1799; also, Thomson's *Chemistry of Organic Bodies—Vegetables*, p. 532.

² Trommsdorff's *Journal*, v. 96.

³ Buchner's *Repertorium*, xxii. 198, 1825.

⁴ *Taschenbuch*, 1826; also, Gmelin, *Handb. d. Chemie*, ii. 618.

⁵ *Memoirs of the Chemical Society*, iii. 10, 1845.

⁶ Dierbach, *Die neuesten Entdeckungen in d. Materia Medica*, Bd. i. S. 235, 1837; from the *Boston Journal*, vol. x. p. 94.

⁷ Geiger's *Pharmacie*, Bd. ii. S. 178, 2te Aufl. 1839.

⁸ *Essays and Observations*, p. 141, 1795.

¹⁰ *Essai sur les Propriétés Méd.*

69. CROCUS SATIVUS, *Allioni*.—THE SAFFRON CROCUS.

Sex. Syst. Triandria, Monogynia.
(Stigma, L.—Stigmata, E. D.)

HISTORY.—Saffron is mentioned in the Old Testament.¹ Homer² speaks of the *crocus* (κρόκος). Hippocrates³ employed saffron in uterine and other maladies. The word *saffron* (za'faran) is probably of Persian origin.

BOTANY. Gen. Char.—*Perianth* [coloured], with a slender tube twice as long as the limb; limb 6-partite, equal, erect. [*Stamens* 3, inserted into the tube; *anthers* sagittate.] *Stigmas* 3, thick, convoluted, generally crested. *Capsule* under ground, elevated by a short peduncle from the root, which peduncle elongates after the decay of the flowers, and the capsules appear above ground. (*Hooker*, with some additions.)

Sp. Char.—*Stigma* protruded, drooping, in 3 deep linear divisions. (*Hooker*.) *Cormus* roundish; its brownish coats reticulated, separating superiorly into distinct parallel fibres. *Leaves* linear, with a white central stripe, and surrounded at their base with long membranous sheaths. *Flowers* light purple, shorter than the leaves, with a two-valved membranous spathe. *Anthers* pale yellow. *Stigmas* deep orange-coloured.

Hab.—A native of Asia Minor. Now naturalized in England, France, and some other European countries. It is a doubtful native of the eastern parts of Europe. It is said to have been introduced into Spain by the Arabs.⁴ It flowers in September and October.

PREPARATION.—The flowers are gathered in the morning, and the stigmata, with a portion of the style, plucked out for use, the rest of the flower being thrown away. The stigmata are then dried on paper, either by means of portable kilns over which a hair-cloth is stretched,⁵ or in a room by the sun.⁶ When dried between paper under the pressure of a thick board and weights, the saffron is formed into cakes now no longer to be met with.

DESCRIPTION.—The only saffron now found in the shops is that called *hay saffron*. The article sold as *cake saffron* is in reality not saffron.

Hay saffron (*crocus in feno*) consists of the stigmata with part of the style, which have been very carefully dried. They are from an inch to an inch and a half long, thin, brownish-red; the upper portion (stigma) is expanded, notched at the extremity; the lower portion, which constitutes part of the style (called by Th. Martius⁷ *Fœminelle*), is narrow, capillary, yellowish. The odour is penetrating, aromatic, and, of large quantities, narcotic. The taste is bitter, somewhat aromatic. When chewed, saffron tinges the mouth and the saliva yellow.

It consists of triparted red filaments having an orange colour; the segments dilated at the apex. Moistened with water and rubbed on paper, it produces an intense orange-coloured stain. —*Ph. Lond.*

I find by careful examination that one grain of good commercial saffron contains the stigmata and styles of nine flowers; hence 4,320 flowers are required to yield one ounce of saffron.

a. *English saffron* (*crocus anglicus*) is no longer found in commerce.

β. *Spanish saffron* (*crocus hispanicus*) constitutes the best saffron of the shops. It is imported from Gibraltar (principally), Cadiz, Denia, Santander, and Malaga. From the concurrent accounts of pharmacologists it would appear that formerly Spanish saffron was spoiled by being dipped in oil to preserve it. But the saffron now imported from Spain has not been subjected to this treatment. Occasionally Spanish, as well as any other kind of saffron, is oiled by the dealers to give it an appearance of freshness.

γ. *French saffron* (*crocus gallicus*) is usually considered in commerce to be of second quality.

¹ *Solomon's Song*, iv. 14.

² *Opera*, Ed. Fœs. pp. 407, 575, 614, 626, and 576.

³ Douglas, *Phil. Trans.* for 1728.

⁶ Fiske, *Stephenson and Churchill's Med. Bot.* vol. iii.

² *Iliad*, xiv. 346.

⁴ Dillon, *Travels through Spain*.

⁷ *Pharmakognosie*, 1832.

It is the produce of Gatinais (*Gatinais saffron*) and Orléanais, which comprehend part of the departments of Seine-et-Marne and Eure-et-Loire, and the whole of the department of Loiret. The saffron of Angoulême is intermixed with the pale styles, and is the worst.¹ French saffron is shipped for England at Calais, Boulogne, and Havre.

Besides the preceding, several other varieties of saffron are mentioned by pharmacologists, but they are not distinguished in English commerce, and I am unacquainted with them. Such are *Austrian*, *Bavarian*, *Oriental*, and the *Sicilian saffron* (*C. austriacus*, *bavaricus*, *orientalis*, and *siiliensis*) mentioned by Murray,² Geiger,³ and others. The saffron of Lower Austria is said to be the best and most costly in Europe, but the produce is scarcely sufficient for the home consumption; and, therefore, saffron is imported into Austria. Austrian saffron is chiefly produced at Ravelsbach, Meissau, Eggendorf, Kirchbeg, and Wagram.⁴

From the Customs report⁵ it appears that saffron is occasionally imported into England from Hamburg, Antwerp, Genoa, Naples, and Bombay. But I am ignorant of its place of growth and quality. According to Gussone,⁶ *Crocus odoratus* yields Sicilian saffron. Dioscorides⁷ considered the saffron of Corycus (a mountain of Cilicia, in Asia Minor, now called *Curco*) to be the best, and that of Lycia and Olympus to be of second quality; while Cyrenaic saffron, as well as that from Centuripinum (*Centorbe*) in Sicily, he declares to be the worst.

Cake saffron (*crocus in placentâ*) was formerly prepared by compressing hay saffron. But the cakes now met with in the inferior shops are composed of Safflower (*Carthamus tinctorius*) and gum-water, made into a paste, and rolled out on a tin plate with a rolling-pin into oval cakes of 11 inches long, 10 inches broad, and about one-tenth of an inch thick. These are dried on brown paper in a stove. They are shining, and of a brownish-red colour. I can detect neither saffron nor marigolds (*Calendula officinalis*) in them. Their price is considerably less than that of good hay saffron. I am informed by a maker of cake saffron that there is only another person besides himself by whom this substance is made in London.

ADULTERATION.—To increase the weight of saffron, it is said to be sometimes intermixed with *sand* or *grains of lead*. To detect these, it is sufficient to scatter the saffron loosely over a sheet of white paper, when the sand or grains of lead fall out.

To give saffron flexibility and an appearance of freshness, as well as to augment its weight, it is sometimes damped or oiled. To detect either *water* or *oil*, a small portion of saffron should be subjected to pressure between folds of white blotting paper; if this become either moistened or greased, the adulteration is obvious.

Another adulteration practised on saffron is intermixing it with the petals of some plant; usually of *safflower* (*Carthamus tinctorius*), which is sometimes called *bastard saffron*. The safflower readily escapes the eye of a superficial observer. If rubbed with the moistened finger on paper, it produces a slightly yellow mark only, whereas genuine saffron causes a very intense orange-yellow stain. The fraud may also be detected by carefully examining the suspected portion by a magnifying glass. The fraud is the more easily detected if the suspected saffron be previously macerated in hot water. Genuine saffron consists of a filiform style, divided at one extremity into three long, convoluted, deep orange stigmata, which are a little dilated upwards and notched at the extremity. Safflower, on the other hand, is composed of florets, each consisting of a monopetalous, tubular, 5-toothed red corolla, inclosing 5 syngenesious stamina and a style. Moreover, the corolla is devoid of the softness and flexibility of the stigmata of saffron; but is, on the contrary, dry and brittle.

Other florets, or strips of petals, artificially dyed to give them colour, and greased with oil to render them supple, have been employed to adulterate saffron. Guibourt mentions the *marigold* (*Calendula officinalis*), *arnica*, and *soapwort* (*Saponaria*), as having been used for this purpose. By attention to the above-mentioned characters of saffron, the fraud may be readily detected. The dilated extremities of the stigmata of saffron are broader than the style: whereas the extremities of the divisions of a strip of a petal will usually be found narrower than the body of the strip.

¹ Guibourt, *Histoire des Drog.* ii. 194, 4ème édit. 1849.

² *App. Med.* vol. v.

³ *Pharmaceutical Journal*, vol. viii. p. 171, 1848.

⁴ Lindley, *Flora Medica*.

⁵ *Handb. der Pharm.*

⁶ *Trade List* for 1837-8-9

⁷ *Lib. i. cap. xxv.*

Genuine saffron, from which the colouring matter has been extracted, is sometimes found in commerce.¹ The sample which I have seen had the essential characters of the stigmata of saffron, but wanted the softness and flexibility of good saffron, and was somewhat darker coloured. It did not present the pale yellow filaments (styles) of ordinary saffron, and imparted no colour to spirit of wine.

Fibres of smoked beef are said to have been used for adulterating saffron.

COMMERCE.—The quantity of saffron on which duty (of 1s. *per lb.*) is paid is about 5,000 lbs. *per annum*. The places from which it is imported have been already mentioned. It is brought over in cases, barrels, and boxes.

COMPOSITION.—Saffron was analyzed, in 1811, by Vogel and Bouillon-Lagrange,² and in 1818 by Aschoff.³

	Vogel and Bouillon-Lagrange.	Aschoff.
Volatile oil	7.5	1.4
Wax	0.5	4.0
Polychroite	65.0	52.0
Gum	6.5	10.4
Soluble albumen	0.5	—
Woody fibre	10.0	19.0
Water	10.0	10.0
Balsamic matter, soluble in ether and alcohol	—	2.0
Saffron	100.0	98.8

1. VOLATILE OIL OF SAFFRON. (*Oleum Croci*)—Obtained by distilling saffron with water. It is yellow, heavier than water, has a burning, acrid, somewhat bitter taste, and is slightly soluble in water. By keeping, it becomes white, solid, and lighter than water. On it depend probably the medicinal properties of saffron.

2. COLOURING MATTER: *Polychroite* (so called from *πολύς*, *many*, and *χρῶς*, *colour*, in consequence of its being susceptible of numerous changes of colour).—By digesting the aqueous extract of saffron in alcohol, and evaporating the tincture to dryness, a substance is obtained which Bouillon-Lagrange and Vogel called *polychroite*, but which Henry⁴ has separated into volatile oil and a bitter red substance (*polychroite properly so called*). Pure *polychroite* is pulverulent, bitter, scarlet-red, odourless, slightly soluble in cold water, much more so in hot water, readily soluble in alcohol and oils (both fixed and volatile), slightly soluble in ether. Sulphuric acid turns it blue, then lilac. Nitric acid makes it green, but the colour is very fugitive. The hypochlorites destroy the yellow colour of a solution of *polychroite*.

CHEMICAL CHARACTERISTICS.—An aqueous infusion of saffron gives no indication of starch on the addition of a solution of iodine. The hypochlorites bleach it. Sulphuric and nitric acids act on it as on *polychroite* above mentioned. Acetate of lead causes no precipitate. By evaporation, the infusion yields an extract from which alcohol removes the colouring matter and leaves a gummy substance.

PHYSIOLOGICAL EFFECTS.—Formerly, saffron was considered to be cordial, aromatic, narcotic, and emmenagogue. Some⁵ have accused it of causing laughing delirium; others⁶ have ascribed to its use great mental dejection; and several⁷ have declared that they have seen immoderate uterine hemorrhage produced by it, which, in the case referred to by Riverius, is said to have terminated fatally. But modern experience has proved that most of these statements are erroneous. Alexander⁸ swallowed four scruples of saffron without perceiving any obvious effects therefrom; and Wibmer⁹ took a drachm without observing the slightest effect.

By the long-continued use of saffron, the colouring particles become absorbed, and tinge the secretions, especially the urine and perspiration. In some instances, the *fætus in utero* has been stained by it.¹⁰ The failure of Alexander to detect the yellow tinge in his secretions arose probably from the short time he had been using this medicine. Mr. Gibson¹¹ gave a considerable quantity of saffron to a pigeon, which thereby had its feces tinged, yet no perceptible alteration was produced in its bones.

¹ *Pharmaceutical Journal*, vol. iii. p. 341, 1843.

² Gmelin, *Handb. d. Chim.* ii. 1334.

³ Boerhaave, *Hist. Plant.* pars ii. p. 590.

⁴ Boerhaave, *op. cit.*; Riverius, *Op. Med.*

⁵ *Wirk. d. Arzneim.* Band ii. S. 204.

⁶ *Mem. of the Lit. and Phil. Soc. of Manchester*, 2d Ser. vol. i. p. 148.

⁷ *Bull. de Pharm.* iv. 89.

⁸ *Journ. de Pharm.* vii. 397.

⁹ Bergius, *Mat. Med.* t. i. p. 32.

¹⁰ *Experim. Essays*, p. 88, 1763.

¹¹ Wibmer, *op. cit.*

Headache, prostration of strength, apoplexy, and even death, have been ascribed to the inhalation of the vapour arising from large quantities of saffron;¹ and perhaps correctly so, for it is well known that the odours of other plants (as the rose, the pink, &c.) act on some individuals as narcotic poisons.²

USES.—Saffron is employed, especially on the Continent, as a flavouring and colouring ingredient in various culinary preparations, articles of confectionery, liqueurs, &c. It was used by the ancients as a perfume as well as a seasoning agent.³

In the modern practice of medicine, it is used chiefly as a colouring ingredient. It is a popular remedy for assisting the eruption of exanthematous diseases; on the same principle, I suppose, that bird-fanciers give it to birds when moulting. It was at one time esteemed as an antispasmodic in asthma, hysteria, and cramp of the stomach; and was formerly used as an emmenagogue, and to promote uterine contractions and the lochial discharge. Lastly, it has been employed as a stimulant to the nervous system in hypochondriasis.

ADMINISTRATION.—It may be given in doses of from ten grains to a drachm, in the form of powder or pill. It is popularly used in the form of infusion or tea.

1. **SYRUPUS CROCI**, L. E. D.; *Syrup of Saffron*.—(Saffron [chopped fine, D.] ʒv [3x, E., ʒss, D.]; Boiling Distilled Water Oj; Sugar lbij [or as much as may be sufficient; Rectified Spirit, fʒijss or as much as may be sufficient, L.]. Macerate the saffron in the water for twelve hours, in a vessel lightly covered, then strain the liquor and add the sugar to it. To the syrup, when cold, add the spirit.)—It is employed principally for its colour.

2. **TINCTURA CROCI**, E. D.; *Tincture of Saffron*.—(Saffron, chopped fine, ʒij; Proof Spirit Oj [Oj, D.]. Macerate for fourteen days, strain, express, and filter, D.—This tincture is to be prepared like tincture of cinchona, either by percolation or by digestion, the former method being the more convenient and expeditious, E.)—Used as a colouring liquid. It is also employed as a stimulant and emmenagogue in doses of from fʒj to fʒij.

As a colouring and flavouring ingredient, saffron is a constituent of several other preparations.

70. *Iris florentina*, Linn.—Florentine Orris.

Sex. Syst. Triandria, Monogynia.
(Rhizoma.)

The orris root (*radix iridis florentina*) of the shops consists of the rhizomes of three species of *Iris*; namely, *I. florentina*, *I. pallida*, and *I. germanica*.⁴ They acquire their well-known violet odour while drying. They are brought to us in the decorated state, in casks, from Leghorn and Trieste.

Orris root consists, according to Vogel,⁵ of volatile oil, acrid resin, astringent extractive, gum, starch, and lignous matter. Raspail⁶ detected in it crystals, which he considered to be those of oxalate of lime. The starch of orris root⁷ consists of elliptical-shaped particles, which form interesting objects for the polarizing microscope. Some of them consist of two mullar shaped particles applied base to base. Most of them are cracked at the hilum, and even at their edges.

¹ See the Reports of Borellus, Tralles, Forster, and others, quoted by Wibmer and Murray, *op. cit.*

² Orfila, *Toxicol. Gén.*

³ Beckmann, *History of Inventions and Discoveries*, vol. i. p. 278.

⁴ According to Savi, orris root is collected in Italy indiscriminately from the three species named in the text. (F. G. Hayne, *Getreue Darst. u. Beschreib. der in d. Arzneykunde gebraucht. Gewächse*, Bd. xi. 1830.)

⁵ *Journ. de Pharm.* i. 481.

⁶ *Chim. Organ.*

⁷ The following measurements, in parts of an English inch, of particles of starch of orris root, were made for me by Mr. George Jackson:—

Particles.	Length.	Breadth.	Particles.	Length.	Breadth.
1	0.0011	0.0010	5	0.0004	0.0004
2	0.0012	0.0006	6	0.0003	0.0002
3*	0.0009	0.0006	7	0.0002	0.0002
4	0.0006	0.0004			

The most prevalent-sized particle is marked thus *.

Schleiden¹ describes the starch particles of *Iris florentina* and kindred species as being perfectly hollow, and apparently cup-shaped.

Orris root is an acrid substance, and in full doses causes vomiting and purging. It is principally used on account of its violet odour. Thus *hair and tooth powders, perfumed oils, &c.*, are frequently scented with it. Issue peas (*pois d'iris*) have been made of it. During teething, infants are sometimes permitted to rub their gums with, and bite, the rhizome; but the practice is objectionable, since it is not unfrequently attended with irritation of the mouth, and disorder of the stomach and bowels. Furthermore, the danger of the rhizome getting into the œsophagus or trachea is not to be overlooked. One fatal case of this kind is recorded.² Powdered orris root is sometimes used as an errhine.

A *tincture of orris root* (*tinctura iridis florentinæ*), prepared by digesting one part of powdered orris root in eight parts of rectified spirit, is used as a scent, and is frequently sold as *essence of violets, or eau de violettes*.

ORDER XIII. TACCACEÆ, Lindley.

CHARACTERS.—A small and imperfectly known order of endogenous plants, with tuberous roots, leaves with curved parallel veins, hermaphrodite regular flowers, a petaloid tubular, 6-parted perianth, 6 stamens, a 1-celled inferior ovary, and seeds with fleshy albumen.

PROPERTIES.—The tuberous roots are bitter and acrid, but by cultivation become larger and milder. They yield a large quantity of nutritive farina.

71. Tacca, Forster.

Sex. Syst. Hexandria, Monogynia.

(Radix; Farina.)

This genus contains two species, which deserve a short notice.

1. *TACCA PINNATIFIDA*, Roxb. Fl. Ind. ii. 172.—A native of the Moluccas and Malay countries. The tuberous roots are intensely bitter when raw, but yield a large quantity of beautifully white starch, used for puddings, cakes, and other articles of confectionery. The tubers “are the *tacca yong* of some navigators; they form an article of diet in China and Cochin China, as also in Travancore,” where, according to Dr. Ainslie, they attain a large size, and are eaten by the natives, with some acid, to subdue their acrimony.³

2. *TACCA OCEANICA*, Nuttall, Amer. Journ. of Pharm. vol. ix. p. 306.—A native of Tahiti, and other islands of the South Sea. Until Mr. Nuttall pointed out its peculiarities, it was supposed to be identical with *T. pinnatifida*. Ellis⁴ says that the “*pia*, or arrow-root, *chailea tacca*” grows on the high sandy banks near the sea, or on the sides of the lower mountains.

The tuberous roots yield a highly nutritious fecula. At Tahiti (Otaheite), this fecula is procured by washing the tubers, scraping off their outer skin, and then reducing them to a pulp by friction on a kind of rasp made by winding coarse twine (formed of the cocoa-nut fibre) regularly round a board.⁵ The pulp is washed with sea-water through a sieve, made of the fibrous web which protects the young frond of the cocoa-nut palm. The strained liquor is received in a wooden trough, in which the fecula is deposited; and the supernatant liquor being poured off, the sediment is formed into balls, which are dried in the sun for 12 or 24 hours, then broken and reduced to powder, which is spread out in the sun to dry.⁶

Tacca starch, or *Tahiti arrow-root*, sometimes called *Otaheite salep*,⁷ is imported into London, and sold as “Arrow-root, prepared by the native converts at the Missionary stations in the South Sea Islands.” It is a white amylaceous powder, with a slightly musty odour. Examined by the microscope, I find it to consist of particles⁸ which appear circular, mullar-shaped, or polyhedral. Some of the mullar-shaped particles are slightly narrowed at the base. Moreover, the base of the mullar, instead of being flat, appears to me to be hollowed out. The hilum is

¹ *Principles of Scientific Botany*, pp. 15–16, translated by Ed. Lankester, M. D., 1849.

² Kraus, *Heilmittellehre*, S. 541.

³ Royle, *Illustrations of the Botany of the Himalayan Mountains*, p. 378.

⁴ *Polynesian Researches*, vol. i. p. 361, 1829.

⁵ Ellis states that the rind of the root is scraped off by a courie shell, and the root then grated on a piece of coral.

⁶ Matthews, *Gardener's Magazine*, vol. viii. p. 585, Lond. 1832.

⁷ Rees's *Cyclopædia*, art. *Tacca pinnatifida*.

⁸ The following measurements, in parts of an English inch, of the particles of Tacca starch, were made for me by Mr. George Jackson:—

Particles.	Length.	Breadth.	Particles.	Length.	Breadth.
1	0.0012	0.0009	4	0.0006	0.0005
2	0.0011	0.0009	5	0.0004	0.0004
3*	0.0008	0.0007	6	0.0003	0.0003

The most prevalent-sized particle is marked thus *.

small and circular; it cracks in a linear or stellate manner. The rings are few and not very distinct.

This fecula is used as a substitute for the West Indian Arrow-root, to which it would probably be equal if it were prepared with equal care. Its composition, like that of other starches, is presumed to be $C^{12}H^{10}O^{10}$.

ORDER XIV. AMARYLLIDACEÆ, *Lindley*.—AMARYLLIDS.

NONE of the plants of this order are employed in England as articles of the *Materia Medica*. Yet many of them act powerfully on the system, and one of them (*Hemanthus toxicarius*) is said to be used by the Hottentots to poison their arrow-heads. The prevailing property of the order is acridity, which is possessed principally by the bulbs, several of which (as those of *Pancreatum maritimum* and *Hemanthus coccineus*) seem to be endowed with properties very similar to those of squill. The leaves and flowers of *Narcissus Pseudo-Narcissus* or *Daffodil* are enumerated among the simples of the French *Codex*. In doses of 20 or 30 grains they sometimes cause vomiting. They have been employed in spasmodic affections (as whooping-cough), in diarrhœa, and in agues.¹ Several other species of *Narcissus*, as *N. Tazetta* and *N. odoratus*, also possess emetic properties.² *Narcissus Tazetta*, the *Italian* or *Polyanthus Narcissus*, is supposed by Dr. Sibthorp to be the *Narcissus* of the poets. The root and succulent leaves of the *Agave Americana* or *American aloe*, a native of Tropical America, yield a saccharine juice which lathers like soap, and when fresh is said to be laxative, diuretic, and emmenagogue. By fermentation it yields an acid liquor. The ligneous fibres of the leaves and roots are used as a thread (*pila thread*).

ORDER XV. MUSACEÆ, *Agardh*.

CHARACTERS.—Leaves with veins curved, and proceeding from the midrib to the margin (curved veined). Perianth 6-parted, adherent, petaloid, irregular; Stamens normally 6, by abortion usually 5; Anthers 2-celled. Ovary inferior, 3-celled. Fruit 3-celled. Seed albuminous.

PROPERTIES.—An important order of endogens, whose fruits (bananas and plantains) form a valuable article of food in some tropical regions.

72. *Musa sapientum*, *Linn.*—Plantain; Banana.

Sex. Syst. Pentandria, Monogynia.³

(Fructûs; Amylum.)

Plantains (*Musa paradisiaca*, *Linn.*) and Bananas (*Musa sapientum*, *Linn.*) are probably only varieties of the same species. The former have a stem wholly green, and persistent male flowers; the latter have a spotted stem, deciduous male flowers, and shorter and rounder fruit. Numerous varieties of each are cultivated in the tropical parts of Asia, Africa, and America; the wild parent is found at Chittagong, and other parts of tropical Asia. The fruit is a berry, and in the unripe state abounds in starch; but during maturation this disappears, being converted into a mucilaginous substance and this into sugar, so that in the ripe fruit not an atom of starch can be detected.⁴

Boussingault⁵ analyzed the ripe fruit of *Musa paradisiaca*, and found in it sugar, gum, malic, gallic, and pectic acids, albumen, and lignin.

Plantains and bananas form important and valuable articles of food to the inhabitants of many tropical regions. "But for plantains," says Dr. Wright,⁶ "Jamaica would scarcely be habitable, as no species of provision could supply their place. Even flour, or bread itself, would be less agreeable and less able to support the laborious negro, so as to enable him to do his business, or to keep in health."

Humboldt⁷ calculates that, as 33 lbs. of wheat and 99 lbs. of potatoes require the same space as that in which 4,000 lbs. of bananas are grown, the produce of bananas is consequently to that of wheat as 133.1, and to that of potatoes as 44.1.

Dr. Shier,⁸ in an interesting report on the starch-producing plants of British Guiana, has given

¹ Mérat and De Lens, *Dict. de Mat. Méd.* t. iv.

² De Candolle, *Essai sur les Propriétés Méd.*

³ I have followed Roxburgh (*Fl. Indica*, vol. i.) in referring this genus to Pentandria, Monogynia. In Reichard's edition of Linnaeus's *Systema Plantarum* (1780), it is placed in Polygamia, Monogynia; and in London's *Encyclopædia of Plants*, it is referred to Hexandria, Monogynia.

⁴ Avequin, *Journ. de Pharm.* t. xxiv. p. 555, 1838.

⁵ *Journ. de Pharmacie*, xxii. 385.

⁶ *London Medical Journal*, vol. viii.

⁷ Humboldt's *Pl. Æquinox.*; also, *Library of Entertaining Knowledge—Vegetable Substances*.

⁸ Report on the Starch-producing Plants of the Colony of British Guiana, Demerara, 1847; also, *Pharmaceutical Journal*, vol. vii. p. 193, 1847.

us some interesting details respecting the plantain. He states that "a new plantain walk in this colony will yield 450 bunches of 50 lbs. each, of which, as nearly as possible, 50 per cent. will be core, containing 17 per cent. of starch, thus producing 17 cwt. of starch per acre." I am indebted to this gentleman for specimens of the *sliced plantain core dried*, *plantain meal*, and *plantain starch*, prepared in April 1847.

Fig. 222.



The Plantain.

Fig. 223.



The Banana.

a. Sliced Plantain core.—The sample sent to me by Dr. Shier was prepared in April, 1847. It was obtained by stripping off the husk of the plantain, slicing the core, and drying it in the sun. The dried slices, as I have received them, are segments of circles from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in diameter, and $\frac{1}{8}$ to $\frac{1}{4}$ of an inch in thickness. Their prevailing tint is whitish, like that of dried slices of colchicum cormi, but marbled with reddish veins. Their odour is fragrant, and somewhat similar to that of orris root. Their taste is farinaceous.

β. Plantain meal; Conquin-tay.—Obtained by powdering and sifting the thoroughly dried sliced plantain core. It is known among the creoles of the colony by the name of *Conquin-tay*. It is a whitish meal, speckled with minute dark-reddish spots. Its odour is fragrant, and similar to that of orris root (Dr. Shier says it resembles fresh hay or tea). Its taste is bland, like that of common wheat flour. When examined by the microscope, it is seen to consist chiefly of starch grains. According to Dr. Shier's statement, plantain meal contains about 68 per cent. of starch. 100.0 parts of plantain meal yielded Dr. Shier 0.88 parts of nitrogen. If this number be multiplied by 6.5 (see *ante*, p. 106, foot-note), we have 5.72 as the per centage amount of proteinaceous matter (albumen, gluten, &c.) contained in plantain meal.

It is obvious, therefore, that plantain meal must be greatly superior to the pure starches, inasmuch as it contains blood- and flesh-making principles which the latter are devoid of. Dr. Shier states that it is easy of digestion, and that it is largely employed in British Guiana as the food of infants, children, and invalids; but it will not serve for the manufacture of macaroni, as this, when made from it, falls to powder when put into hot water. The same authority tells us that the plantain yields about 20 or 25 per cent. of meal.

γ. Plantain starch.—This is obtained from the plantain by rasping and washing; but owing to the flesh-coloured tissue in which the starch is imbedded being somewhat denser than the latter, it settles below the starch, and it is somewhat difficult to separate completely the finer parts of it from the starch; hence the latter is not perfectly white. The plantain yields about 17 per cent. of starch. Examined by the microscope, I find the starch grains¹ to be flat, transparent disks, like those of the starch of Zingiberacæ; hence they have but little lateral shading, and when superimposed the contour of the lower grains can be seen through the upper ones. Their shape is more or less elliptical and ovate, the extremity at which the so-called nucleus or hilum is placed being narrower than the opposite one. When viewed edgewise, their shape appears to be linear, and the lateral shading is stronger.

¹ The following measurements, in parts of an English inch, of the particles of plantain starch (prepared by Dr. Shier, of Demerara) were kindly made for me by Mr. George Jackson:—

Particles.	Length.	Breadth.	Particles.	Length.	Breadth.
1	0.0020	0.0013	5*	0.0013	0.0008
2	0.0018	0.0009	6	0.0009	0.0006
3	0.0016	0.0010	7	0.0007	0.0005
4*	0.0014	0.0007	8	0.0005	0.0003

The most prevalent-sized particles are marked thus *.

The lines or segments of rings seen on the flat surfaces of the grains do not extend to the edges of the grain, nor do they surround the hilum. When examined by the polarizing microscope, these grains present the well-known crosses. In its chemical, dietetical, and medicinal properties, the starch of the plantains agrees with those of other starches.

ORDER XVI. MARANTACEÆ, Lindl.

CANNACEÆ, Agardh.

CHARACTERS.—*Calyx* superior, of 3 sepals, short. *Corolla* tubular, irregular, with the segments in 2 whorls; the *outer* 3-parted, nearly equal, the *inner* very irregular; one of the lateral segments usually coloured, and formed differently from the rest; sometimes by abortion fewer than 3. *Stamens* 3, petaloid, distinct, of which one of the lateral and the intermediate one are either inactive or abortive, and the other lateral one fertile. *Filament* petaloid, either entire or 2-lobed, one of the lobes bearing the anther on its edge. *Anther* 1-celled, opening longitudinally. *Pollen* round (papillose in *Canna coccinea*, smooth in *Calathea zebrina*). *Ovary* 1-3 celled; *ovules* solitary and erect, or numerous and attached to the axis of each shell; *style* petaloid or swollen; *stigma* either the mere denuded apex of the style, or hollow, hooded, and incurved. *Fruit* capsular, as in Scitamineæ. *Seeds* round, without aril; *albumen* hard, somewhat floury; *embryo* straight, naked, its *radicle* lying against the hilum. *Herbaceous* tropical plants, destitute of aroma. *Rhizome* often tuberous, and abounding in starch. *Stem* often branching. (Lindley)

PROPERTIES.—The rhizomes frequently abound in starch.

73. MARANTA ARUNDINACEA, Linn.—THE WEST INDIAN ARROW-ROOT.

Sex. Syst. Monandria, Monogynia.

(*Tuberis fæcula. Ph. Lond.*—*Fecula* of the tubers; Arrow-root. *Ed., D.*)

HISTORY.—This plant was brought from the island of Dominica, by Colonel James Walker, to Barbados, and there planted. From thence it was sent to Jamaica. That gentleman observed that the native Indians used the root against the poison of their arrows, by mashing and applying it to the poisoned wounds.¹

The valuable properties of the starch made from the root are mentioned by Hughes,² in 1751, and the mode of procuring it described by Browne,³ in 1789.

BOTANY. Gen. Char.—*Corolla* unequal, one of the inner segments in the form of a lip. *Stamens* petaloid, with half an anther on its edge. *Style* hooded, adhering to the edge of a sterile filament. *Ovary* 3-celled, smooth; *ovules* solitary. *Fruit* even, dry, 1-seeded.—Caulescent plants with fleshy *rhizomata* or *tubers*. *Stems* branched, often dichotomous. *Inflorescence* terminal, panicled, jointed, with glumaceous, deciduous *bracts*. (Lindley.)

Sp. Char.—*Culm* branched, herbaceous. *Leaves* ovate, lanceolate, somewhat hairy underneath. *Peduncles* 2-flowered (Willdenow).

Rhizome white, articulated, tuberous, placed horizontally in the earth, and giving origin to several tuberous jointed stoles (*stolones tuberosi*), similar to itself, but covered with scales. Those stoles are often more than a foot long, and curved, so that the points rise out of the earth and become new plants (Nees and Ebermaier). *Stem* two or three feet high. *Leaves* alternate, with long, leafy, hairy sheaths. *Flowers* white and small.

The *Maranta indica*, Tussac,⁴ E., is characterized by its leaves being smooth on both sides, and by its seeds; those of *M. arundinacea* being violet. But, after a careful examination, Wickström declares that Tussac's plant is identical with the *M. arundinacea*, Linn.⁵

Hab.—West Indies. It is cultivated both in the West and East Indies, Ceylon, Sierra Leone, &c.

COMPOSITION OF THE ROOT.—According to P. C. Benzon,⁶ the root of the *Maranta*

¹ Sloane's *Jamaica*, vol. i. p. 254.

² *The Civil and Natural History of Jamaica*, p. 112, 1789.

³ Nees v. Esenb. and Eberm. *Handb. d. Med. pharm. Bot.*

⁴ Buchner's *Repertorium für die Pharmacie*, Bd. xvi. S. 255, 1823.

⁵ *The Natural History of Barbados*, p. 221, 1750.

⁶ *Journ. Bot.* iii. 41.

has the following composition: *volatile oil*, 0.07; *gummy extract*, 0.50; *starch*, 26.00; *woody fibre*, 6.00; *albumen*, 1.58; *muriate of lime*, 0.25; and *water*, 65.600.

The per centage quantity of starch obtained from the root has been thus stated by other authorities: 7.81 (Dr. J. Clark),¹ 12.5 (De Candolle),² 21.43 (Dr. Shier³ from roots scarcely ripe).

EXTRACTION OF THE FECULA.—The starch, or fecula, is extracted from the roots (tubers) when these are about ten or twelve months old. The process is entirely a mechanical one, and is performed either by hand or by machine.

In Jamaica, it is procured as follows: The tubers are dug up, well washed in water, and then beaten in large, deep, wooden mortars to a pulp. This is thrown into a large tub of clean water. The whole is then well stirred, and the fibrous part wrung out by the hands and thrown away. The milky liquor being passed through a hair-sieve, or coarse cloth, is suffered to settle, and the clear water is drained off. At the bottom of the vessel is a white mass, which is again mixed with clean water and drained; lastly, the mass is dried on sheets in the sun, and is pure starch.⁴

In Bermuda⁵ the roots are first deprived of their paper-like scales, and then rasped by a kind of wheel-rasp (something like Fig. 224, p. 228), and the fecula well washed through sieves and carefully dried.

Upon the Hopewell estate, in the Island St. Vincent,⁶ the carefully-skinned tubers are washed, then ground in a mill, and the pulp washed in tinned-copper cylindrical washing-machines. The fecula is subsequently dried in drying houses. In order to obtain the fecula free from impurity pure water must be used, and great care and attention paid in every step of the process. The skinning or peeling of the tubers must be performed with great nicety, as the cuticle contains a resinous matter, which imparts colour and a disagreeable flavour to the starch. German silver palettes are used for skinning the deposited fecula, and shovels of the same metal for packing the dried fecula. The drying is effected in pans covered by white gauze to exclude dust and insects.

COMMERCE.—Arrow-root is brought, in tin cases and in barrels and boxes, from the West India Islands (Jamaica, Barbados, Antigua, St. Vincent, Dominica, Bermuda, St. Kitt's, Grenada, Demerara, and Berbice), Calcutta, and Sierra Leone.

The packages of West-Indian arrow-root sent to this country are lined with paper attached with arrow-root paste. When sent to this country in the hold of the ship, their contents are easily tainted by noisome effluvia.

Arrow-root is usually distinguished by the name of the island or place producing it; as *Bermuda arrow-root*, *St. Vincent's arrow-root*, *Jamaica arrow-root*, *African or Sierra-Leone arrow-root*, &c. Bermuda arrow-root is the most esteemed variety. In 1845, about 400,000 lbs. were manufactured, of which more than three-fourths came to England. Dr. Ure says that the St. Vincent's arrow-root prepared on the Hopewell estate vies with the Bermuda sort.

In commerce, the term *arrow-root* is frequently used generically to indicate a starch or fecula. The following are illustrations of its use in this way:—

Portland Arrow-root is obtained from *Arum maculatum* (see *ante*, p. 158).

East India Arrow-root is the fecula procured from *Curcuma angustifolia*, and will be described hereafter. But the West Indian plant (*Maranta arundinacea*) is also cultivated in the East Indies, and the fecula obtained therefrom is exported from thence, and might with equal propriety be called *East India arrow-root*.

Brazilian Arrow-root is the fecula of *Jatropha Manihot*, and will be noticed hereafter (vide EUPHORBIACEÆ).

Tahiti Arrow-root is the fecula of *Tacca oceanica*, and has already been noticed (see *ante*, p. 221).

¹ *Medical Facts and Observations*, vol. vii. 1797.

² *Physiologie Végétale*, t. i. p. 187, 1832.

³ *Report on the Starch-producing Plants of the Colony of British Guiana*, p. 11, Demerara, 1847.

⁴ *Wright, London Medical Journal*, vol. viii.

⁵ Cogswell, in *Cornack's Monthly Journal of Medical Science*, vol. v. p. 789, 1845.

⁶ *Recent Improvements in Arts and Manufactures*, by A. Ure, M. D., 1844.

PROPERTIES.—The starch or fecula (*amylum vel fæcula marantæ*), called in the shops *West Indian arrow-root*, or simply *arrow-root*, is white, odourless, and tasteless. It is in the form either of a light opake white powder, or of small pulverulent masses. When passed between the fingers, it feels firm, and, when rubbed, produces a slight crackling noise. When viewed by a good pocket lens, it is seen to consist of glistening particles. When examined by a microscope, these are seen to be convex, more or less elliptical, and moderately uniform in size.¹ The shape is more or less irregular, but often oblong, or usually somewhat ovate-oblong, frequently obscurely triangular, or oyster-shaped, or mussel-shaped.² After having been digested for a short time in water, one, or rarely two, mammillary processes are, in some samples, seen projecting from the surface of some of the particles. In some specimens, these processes have appeared like short spines. The rings are very distinct, though fine. The nucleus, central cavity, or hilum is usually very distinct, generally towards one end of the particle normally circular, but frequently cracked in a linear or stellate manner. When viewed by the polarizing microscope, the particles show very distinct crosses: the junction of the arms of the cross indicates the position of the hilum.

COMPOSITION OF THE STARCH.—Arrow-root has been analyzed by Dr. Prout³ and by Payen,⁴ who obtained the following results:—

PROUT.				PAYEN.		
	Air dried.	Dried be- tween 200° and 212° for 20 hours.	Dried at 212° for 6 hours longer.		Portion most easily dis- aggregated, dried at 212° F.	Amidon intact purified by alcohol & water, and dried at 382° F.
Carbon	36.4	42.8	44.4	Carbon	44.3	44.33
Water	63.6	57.2	55.6	Hydrogen	6.2	6.25
				Oxygen	49.5	49.42
Arrow-root . .	100.0	100.0	100.0	Arrow-root . .	100.0	100.00

The formula which agrees with Prout's third analysis is $C^{12}H^{10}O^{10}$.

Dr. Prout regards arrow-root as a low variety of starch analogous to the low sugar of honey; while wheat-starch he considers to be the most perfect form of starch, analogous to sugar-candy.

SUBSTITUTIONS, IMPURITIES, AND ADULTERATIONS.—The presence of accidental impurities (such as insects, dust, &c.) may be readily detected by alterations in the colour, odour, and flavour of the arrow-root.

Other cheaper feculas are sometimes substituted for the genuine arrow-root; especially sago-meal, potato-starch, and tapioca-starch or Brazilian arrow-root.

The fraud is readily detected by the microscope.⁵ When squeezed in the hand, the sago-meal crackles like arrow-root; but when submitted to microscopic examination, the truncated extremity of many of the particles giving them either a mullar shape or dihedral summit, the irregular or tuberculated surface, and the size of the particles, readily served to distinguish it from arrow-root.

¹ The following measurements, in parts of an English inch, of the particles of West India arrow-root, were kindly made for me by Mr. George Jackson:—

Particles.	Length.	Breadth.	Particles.	Length.	Breadth.
1	0.0020	0.0013	4	0.0008	0.0005
2	0.0012	0.0009	5	0.0006	0.0004
3*	0.0010	0.0008	6	0.0005	0.0003

The most prevalent-sized particle is distinguished thus *.

² Schleiden (*Principles of Scientific Botany*) describes the granules as being compound, without evident central cavity, and always exhibiting the smooth connecting surfaces; but this description does not apply to commercial West Indian arrow-root.—Raspail has depicted the grains of the fecula of *Convolvulus Batatas* for arrow-root (see Payen, *Ann. Scienc. Nat.* 2de Sér. t. x. Botanique, p. 18, 1835).

³ *Phil. Trans.* 1827.

⁴ *Lancet*, Feb. 1, 1851.

⁵ *Ann. des Scienc. Nat.* 2de Sér. Botanique, 1838, pp. 183-184.

Potato-starch is sometimes sold for West Indian arrow-root. I have met with it in commerce under the name of English arrow-root. It is devoid of the dull or dead white appearance presented by West India arrow-root. The naked eye, or still better a pocket lens, readily distinguishes its large glistening particles from those of genuine arrow-root. The microscope instantly detects the difference. The particles of potato-starch are larger than those of arrow-root, and have coarser and more distinct rings. Moreover, the shape of the particles serves to distinguish them (see *Potato-starch*). Lampadius¹ observed that potato-starch evolves a peculiar odour when boiled with water and sulphuric acid, and that arrow-root does not evolve this odour when treated in a similar way. Arrow-root, moreover, "is destitute of that fetid, unwholesome oil, extractible by alcohol from potato-starch."² Mixed with one and a half, or twice its weight, of concentrated hydrochloric acid, arrow-root yields an opaque paste, whereas that produced by potato-starch is transparent. Arrow-root takes a longer time than potato-starch to become viscid when mixed with equal parts of acid and water.³

Other kind of feculas, which are said to have been substituted (on account of their cheapness) for the genuine arrow-root, such as East India arrow-root or Curcuma starch (see *Curcuma angustifolia*), and Brazilian arrow-root or tapioca-starch (see *Jatropha Manihot*), are readily distinguishable by the microscope.

PHYSIOLOGICAL EFFECTS.—By the Indians of South America, and even by some Europeans, the roots (tubers) have been supposed to possess alexipharmic properties.⁴ But their chief if not their only real value is that of yielding the starch called *arrow-root*, which is a much esteemed non-nitrogenized alimentary principle, which, like some other agents of this kind (see vol. i. p. 116), are useful in the animal economy for the production of fatty and saccharine matters, lactic acid, and heat. Arrow-root is one of the most palatable and digestible of the starches.

USES.—The roots (tubers) have been used by the South American Indians to counteract the effects of wounds inflicted by poisoned arrows. Very recently⁵ the expressed juice of the root has been lauded as an antidote to poisons taken into the stomach, and to the bites and stings of venomous insects and reptiles.

The starch or *arrow-root* is employed at the table as an article of food, in the forms of puddings. It forms an agreeable, non-irritating diet for invalids or infants. In irritation of the alimentary canal, of the pulmonary organs, or of the urinary apparatus, it is especially valuable as a nutritive, emollient, and demulcent.

ADMINISTRATION.—To invalids and infants arrow-root (the starch) is exhibited when boiled in water or milk and flavoured. Milk disagrees with some patients, and in such is of course to be avoided. The addition of sugar improves the flavour and increases the nutritive qualities. Spices, lemon juice, or wine may be employed according to circumstances.

74. *Canna edulis*, Ker.—Tous-les-Mois?

Sex. Syst. Monandria, Monogynia.

(*Canna*. Fecula of the root of an imperfectly determined species of *Canna*. *Tous-les-Mois*, E.—The root is supposed to furnish the fecula called *Tous-les-Mois*, D.)

The starch or fecula called *Tous les-Mois* was introduced to the notice of the British public by the late Mr. Olpherts⁶ of St. Kitts, about 1836. It was at first stated to be the produce of *C. coccinea*; but as this species, like *C. indica*, has fibrous, and not tuberous roots, it is tolerably clear that this cannot be the source of the starch in question.

There is good reason for believing that *C. edulis* of Ker is a native of the West Indies, and that it is the species which yields *tous les-mois*. Descourtillz⁷ and Lunan⁸ speak of a species of

¹ *Pharmaceutisches Central-Blatt für 1832*, S. 638.

² Ure, *Recent Improvements in Arts, Manufactures, and Mines*, p. 10, 1844.

³ Scharling, *Pharmaceutical Journal*, vol. ii. p. 417, 1843.

⁴ *Stoane's Jamaica*, vol. i. p. 251.

⁵ *Hamilton, Pharmaceutical Journal*, vol. vi. pp. 23 and 25, 1847.

⁶ *Hamilton, Pharm. Journal*, vol. vii. p. 56, 1847; also, the *Medico-Chirurg. Review* for Oct. 1, 1836; and *Ryan's Med. and Surg. Journal* for August, 1836.

⁷ *Fl. Méd. des Antilles*, p. 3, tab. 210.

⁸ *Hortus Jamaicensis*, vol. ii. p. 417.

Canna with fleshy tuberous roots, which grows in the West Indies, and which they call *C. indica*. But the character of the roots just mentioned shows that the West Indian plant is not *C. indica*. Linn. Ruiz and Pavon¹ speak of a South American plant which they term *Canna indica* of Linnaeus, whose fleshy tubers are eaten by the Peruvians, who call the plant *Achira*. They considered it to be the *C. Indica* of Linn. But when their herbarium came into Mr. Lambert's possession, he raised plants from the seeds of the original specimens, and found the species to be a new one, which he named *C. edulis*.²

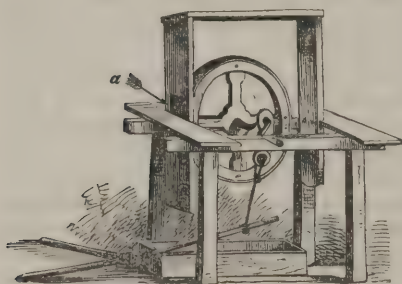
Mr. Lambert afterwards received seeds, from Dr. Gillies of Mendoza, of a *Canna* known in South America as "*Achira*." This has been described and figured³ as a new species under the name of *C. Achiras* (more properly *C. Achira*); but it is not improbable that it may prove to be identical with *C. edulis*.

C. glauca is also said to yield a valuable starch.⁴

My friend Mr. Wordsworth, assistant-surgeon to the London Hospital, and who resided some time at St. Kitts, tells me that he cultivated the *Tous-les-Mois* in his garden. Its height was about 4 feet; and its tubers three or four times the size of the fist. In order to extract the fecula, the tubers are rasped by means of a circular or wheel-rasp⁵ worked by a treddle. The tuber is held against the edge of the rasp, at the point marked *a* in the accompanying figure. The starch is obtained from this pulp by the ordinary methods of washing, straining, decantation of the supernatant liquor, and desiccation of the deposited starch.

The quantity of starch procured from the roots of the *tous-les-mois* plant has not been satisfactorily ascertained. Ricord Madianna⁶ obtained from a pound of the root two ounces of a starch of fine quality; this is equal to 12.5 per cent. It is probable, however, that

Fig. 224.



Wheel-rasp used for rasping the tubers of the *Tous-les-Mois* plant.

on the large scale the product would be much greater.

Tous-les-mois starch is imported from St. Kitts. To the naked eye it greatly resembles potato-starch. On account of the large size of its particles, it has a satiny or glistening appearance, and is devoid of that dead white or opake appearance presented by the West Indian arrow-root. Examined by a pocket lens, the sparkling and glistening appearance of its particles is very obvious. When submitted to examination by means of the compound microscope, its particles are seen to be very large⁷ (in this respect exceeding those of all other starches), somewhat egg-shaped, to have a very distinct nucleus, central cavity, or hilum, and concentric rings indicative of their laminated structure. Strictly speaking, their shape is oval or oblong; but generally more or less ovate. The circular hilum is usually placed at the narrow extremity; very rarely it is double; once I have seen it treble. The rings are numerous, regular, close, but somewhat unequally so. The hilum and the body of the particle are frequently cracked.

Potato-starch is the only amylaceous substance which can be confounded with *tous-les-mois*. The two starches may be distinguished by a careful attention to their relative sizes and shapes, to the appearance of their rings, the position of the hilum, and the action of polarized light on them.

First, the particles of potato-starch are on the average smaller than those of *tous-les-mois*, and are subject to greater irregularity of size (both as regards different sorts of potatoes and the different particles of the same potato).

Secondly, the larger particles of potato-starch are more irregular in shape than those of *tous-les-mois*; the latter are more constantly rounded or oblong or ovate-oblong; the former are oval, often approximating in shape to an oyster-shell, a mussel-shell, or a triangle with rounded corners, and being frequently gibbous or tumid at different parts of their surface.

Thirdly, the rings seen on particles of *tous-les-mois* are fine, regular, uniform, concentric, and

¹ *Flora Peruviana*.

² *Ibid.* tab. 1358.

³ Piso (*Hist. Nat. Brasiliæ*, p. 53, 1648) represents a somewhat similar machine as being used in the preparation of cassava or tapioca starch.

⁴ *Journ. de Pharmacie*, t. xvi. p. 306, 1830.

⁵ The following measurements, in parts of an English inch, of the particles of "*tous-les-mois*," were made for me by Mr. George Jackson:—

Particles.	Length.	Breadth.	Particles.	Length.	Breadth.
1	0.0042	0.0035	4*	0.0032	0.0020
2	0.0037	0.0026	5*	0.0025	0.0017
3*	0.0031	0.0027	6	0.0013	0.0010

The most prevalent-sized particles are those marked thus *.

⁶ *Botanical Register*, tab. 7.

⁷ Bennett, *Ceylon and its Capabilities*, p. 127, 1843.

crowded; those of potato-starch are coarser, irregular, often excentric, irregularly drawn out, distorted, or more and unequally distant from each other. In potato-starch a greater number of complete rings is visible, and we can trace the lines around the hilum, even in the case of many of the larger rings; but in *tous-les-mois* this can be done with a very few of the smaller rings only.

Fourthly, in both the hilum is situated nearer to the end of the particle; but in potato-starch this character is less obvious, the hilum frequently being less distant from the centre of the particle than in the case of *tous-les-mois*.

Lastly, when viewed by polarized light the cross is less frequently regular in potato-starch than in *tous-les-mois*; in the former, the arms are often distorted.

Tous-les-mois of commerce contains about 16.74 per cent. of hygroscopic water. It is very soluble in boiling water; and, according to Dr. Shier's experiments, yields a jelly, which is considerably more tenacious than the jelly of any other starch; but which, in clearness or translucency, is inferior to that of arrow-root, and of some other substances.

The composition of *tous-les-mois* starch is assumed to be the same as that of other starches, viz., $C^{12}H^{10}O^{10}$.

In its dietetical qualities *tous-les-mois* resembles other starches (see vol. i. p. 116). It yields very agreeable articles of food for invalids and others, and appears to be very readily digested.

ORDER XVII. ZINGIBERACEÆ, Lindl.—GINGERWORTS.

DRYMYRHIZÆ, Vent.—SCITAMINÆ, R. Brown.

CHARACTERS.—*Calyx* superior, tubular, 3-lobed, short. *Corolla* tubular, irregular, with 6 segments in 2 whorls; the *outer* 3-parted, nearly equal, or with the odd segment sometimes differently shaped; the *inner* (sterile stamens) 3-parted, with the intermediate segment (*labellum*) larger than the rest, and often 3 lobed, the lateral segments sometimes nearly abortive. *Stamens* 3, distinct, of which the 2 lateral are abortive, and the intermediate one fertile; this placed opposite the *labellum*, and arising from the base of the intermediate segment of the outer series of the corolla. *Filament* not petaloid, often extended beyond the anther in the shape of a lobed or entire appendage. *Anther* 2-celled, opening longitudinally, its lobes often embracing the upper part of the style. *Pollen* globose, smooth. *Ovary* 3-celled, sometimes imperfectly so; *ovules* several, attached to a placenta in the axis; *style* filiform; *stigma* dilated, hollow. *Fruit* usually capsular, 3-celled, many seeded [sometimes by abortion 1-celled]; occasionally berried (the dissepiments generally central, proceeding from the axis of the valves, at last usually separate from the latter, and of a different texture, R. Br.). *Seeds* roundish or angular, with or without an aril (*albumen* floury, its substance radiating, and deficient near the hilum, R. Br.); *embryo* enclosed within a peculiar membrane (*vitellus*, R. Br. Prodr. *membrane of the amnios*, ibid. in King's Voyage, 21), with which it does not cohere.—Aromatic, tropical, *herbaceous* plants. *Rhizome* creeping, often jointed. *Stem* formed of the cohering base of the leaves, never branching. *Leaves* simple, sheathing their *lamina*, often separated from the sheath by a taper neck, and having a single midrib, from which very numerous, simple, crowded veins diverge at an acute angle. *Inflorescence* either a dense spike, or a raceme, or a sort of panicle, terminal or radical. *Flowers* arising from among spathaceous membranous bracts, in which they usually lie in pairs. (Lindley.)

PROPERTIES—The rhizomes contain a volatile oil and resin, which confer on them aromatic or acro-aromatic qualities. Many of them abound in starch, the particles of which (like those of plantain starch, see *ante*, p. 223) are flattened disks. This is sometimes extracted and used as food. Some of them are remarkable for the yellow colouring matter which they yield.

The seeds also contain volatile oil and resin; and possess aromatic or acro-aromatic qualities.

75. ZINGIBER OFFICINALE, Roscoe.—THE NARROW-LEAVED GINGER.

Amomum Zingiber, Linn. D.
Sez. Syst. Monandria, Monogynia.
 (Rhizoma, L. E.—Radix, D.)

HISTORY.—Dioscorides¹ and Pliny² speak of ginger: the former calls it ζιγγίβερις; the latter *zingiberi* and *zingiberi*.

BOTANY. *Gen. Char.*—*Corolla* with the outer limb 3-parted, inner 1-lipped. *Filament* lengthened beyond the anther into a simple incurved beak. *Capsule* 3-celled, 3-valved. *Seeds* numerous, arillate.—*Rhizocarpial* plants. *Rhizomes* tu-

¹ Lib. ii. cap. 190.

² Hist. Nat. lib. xii. cap. 14, ed. Vulp.

berous, articulated, creeping. *Stems* annual, enclosed in the sheaths of distichous leaves. *Leaves* membranous. *Spikes* cone-shaped, radical or rarely terminal, solitary, consisting of 1-flowered imbricated bracts (Blume¹).

Sp. Char.—*Leaves* sub-sessile, linear-lanceolate, smooth. *Spikes* elevated, oblong. *Bracts* acute. *Lip* 3-lobed. (Roxburgh.)

Rhizome biennial. *Stems* erect and oblique, and invested by the smooth sheaths of the leaves; generally three or four feet high, and annual. *Leaf-sheaths* smooth, crowned with a bifid ligula. *Scapes* solitary, six to twelve inches high. *Spikes* the size of a man's thumb. *Lip* dark purple. *Ovary* oval, with numerous *ovules*; *style* filiform; *stigma* funnel-shaped, ciliate. *Capsule* roundish, unilocular. *Seeds* numerous; mostly abortive.²

Hab.—Cultivated in the tropical regions of Asia and America, and at Sierra Leone. Native soil doubtful, probably Asia.

PREPARATION.—*Green ginger* is sometimes imported from Jamaica. It consists of soft and juicy rhizomes with buds; and appears to have undergone but little preparation beyond picking and washing.

The young shoots put forth every spring by the perennial rhizome are used in the manufacture of the delicious *preserved ginger* (*conditum zingiberis*). These shoots are carefully picked, washed, scalded, scraped, peeled, and then preserved in jars with syrup. (Dr. P. Browne.)

The finest preserved ginger is imported from Jamaica usually in jars. Barbados preserved ginger is seldom brought over. The China preserved ginger is stringy. It is sometimes imported in the dried state.

The dried rhizomes, called in the shops *ginger* (*radix zingiberis*), are prepared when the stalks are wholly withered, and the rhizomes are about a year old. In Jamaica, this happens in January or February. The rhizomes are dug up and separately picked, washed, and scraped; and afterwards dried in the sun and open air. (Dr. P. Browne.) The product is the uncoated ginger of the shops, formerly called *white ginger* (*zingiber album*).

The coated ginger of the shops has obviously not undergone this careful preparation. In Barbados, the rhizomes are dug up, scraped clean, and sun-dried.³ The *black ginger* (*zingiber nigrum*), formerly prepared in Jamaica, is obtained by pickling and cleaning the rhizomes, scalding them gradually in boiling water, and afterwards sun-drying them.⁴

DESCRIPTION.—The *rhizome*, called in commerce *ginger root* or simply *ginger* (*radix zingiberis*), occurs in flattish, jointed, branched, or lobed, palmate pieces, called *races* or *hands*, which rarely exceed four inches in length.

Barbados ginger, the old sorts brought from Malabar and Bengal, and African ginger, are covered by a dry, shrivelled epidermis commonly called the "coat;" hence these sorts are usually said to be *coated* or *unscraped*; whereas the ginger of Jamaica, and the new sorts which of late years have been brought from Malabar and Bengal, have been deprived of their epidermis, and are, therefore, said to be *uncoated* or *scraped*. The external colour varies in the different sorts from pale or bright yellow to dark or brown: the palest sort is the fine Jamaica ginger; the darkest being the Bengal old sort; and the other sorts being intermediate. Ginger breaks moderately short, but the fractured surface presents numerous projecting pointed fibres, imbedded in a mealy or farinaceous tissue. A transverse section of the larger and more perfect pieces shows an outer, horny, resinous-looking zone, surrounding a farinaceous centre, which has a speckled appearance from the cut extremities of the fibres and cuts. The internal varies like the external colour; the best ginger is that which cuts pale but bright. The consistence of ginger, as

¹ *Enumeratio Plantarum Javæ.*

² Roxburgh, *op. cit.*; and Dr. P. Browne, *History of Jamaica*.

³ Hughes, *Nat. Hist. of Barbados*, p. 233, 1750.

⁴ Dr. P. Browne, *op. cit.*—According to Dr. Wright (*Lond. Med. Journ.* vol. viii.; also, *Memoir of the late Dr. Wright*, p. 185, 1828), two sorts of ginger are cultivated in Jamaica, viz., the white and the black; the latter has the more numerous and the larger roots.

ascertained by cutting, varies from soft to hard, or, as it is termed in trade, "flinty;" the soft being preferred. The taste of ginger is aromatic, hot, and biting; the odour of a fresh broken piece is peculiar and pungent, though aromatic.

VARIETIES.—Seven kinds of ginger, distinguished partly by their place of growth, and partly by their quality, are known in English commerce. Of these, two are from the West Indies, four from the East Indies, and one from Africa.

A. West Indian Gingers.—This division includes Jamaica and Barbados gingers.

1. *Jamaica ginger.*—Imported in barrels holding 1 cwt. each. It is an uncoated, pale sort, and when of fine quality occurs in large, bold, fleshy races, which cut soft, bright, and pale coloured. Inferior samples are small in the race, darker coloured, more or less flinty, and shrivelled.

2. *Barbados ginger.*—Imported in bags of about 60 or 70 lbs. It is a coated sort, in short, flat races, which are darker coloured than Jamaica ginger, and are covered with corrugated epidermis.

B. East Indian Gingers.—This division includes two sorts from Malabar and two from Bengal, all of which are more liable to be wormy than either the West Indian or African sorts.

a. Malabar Gingers.

3. *Coated Malabar Ginger; Unscraped Malabar Ginger; Old sort of Malabar Ginger; Common Malabar Ginger; Bombay Ginger.*—Imported from Bombay in bags or packets. It is a coated, dark, small sort.

4. *Uncoated Malabar Ginger; New sort of Malabar Ginger; Tellicherry Ginger; Calicut Ginger; Cochin Ginger.*—A pale, uncoated sort, imported in chests, casks, or bags, sometimes from Tellicherry, but usually from Calicut or Cochin. It resembles Jamaica ginger both in external appearance and flavour; but has externally more of a brownish or reddish tint. It first appeared in English commerce about 1841.

β. Bengal Gingers.

5. *Coated Bengal Ginger; Common Bengal Ginger; Old sort of Bengal Ginger.*—Imported in bags. It is a coated or unscraped dark sort, which cuts flinty and brownish, but is plumper and less wormy than common Malabar ginger.

6. *Uncoated Bengal Ginger; Scraped Bengal Ginger; New sort of Bengal Ginger; Calicut sort of Bengal Ginger.*—Imported in chests of about 1½ cwt. It is an uncoated sort, darker than Jamaica ginger. It is not so large as the uncoated Malabar sort, and is harder and darker.

C. African Ginger.—Only one kind of African ginger is known, viz., that from Sierra Leone.

7. *Sierra Leone Ginger; African Ginger.*—Imported in casks or bags. It is a coated sort; the races being generally larger, less flat, and less plump than those of the Barbados sort, which in other respects they resemble.

Chinese Ginger.—The Chinese ginger described by Bassermann¹ is unknown in English commerce; the only ginger imported into England from China being *preserved ginger*.

ASSORTMENT.—The uncoated gingers, namely, the Jamaica, uncoated Malabar, and uncoated Bengal, are assorted for commercial purposes, according to their qualities, somewhat thus—

1. Bold, soft, and bright ginger.
2. Smaller, but soft and bright.

3. Flinty and dark.
4. Shrivelled, and only fit for grinding.

The Barbados, African, and coated Malabar and Bengal gingers are usually sold unassorted.

The following are the quantities of ginger on which duty was paid for six years:—

¹ *Pharmaceutisches Central-Blatt für 1835.*

	British West Indies.	East Indies.	Total.
	cwts.	cwts.	cwts.
In 1825	6,496	867	= 7,363
1836	4,426	1,912	= 6,338
1837	9,157	3,520	= 12,677
1838	9,305	1,911	= 11,216
1839	6,357	818	= 7,175
1840	7,528	1,535	= 9,063

WASHED GINGER; BLEACHED GINGER.—Ginger is sometimes washed in water, and then dried, by wholesale dealers, prior to its being offered for sale to the retailers.

Some of the darker sorts are bleached by washing them in a solution of chloride of lime, and sometimes by exposing them to the fumes of burning sulphur. By this treatment the ginger acquires a chalky-white character, and is then often termed *white-washed ginger*.

Ginger is said¹ to be sometimes washed in whiting and water (or white-washed) under the pretence of preserving it from insects.

ADULTERATION.—Powdered ginger is said to be sometimes admixed with flour and other amylaceous substances. The microscope would readily detect the adulteration, except in the case of East Indian arrow-root (*Curcuma angustifolia*), the particles of which are similar in appearance to those of ginger.

COMPOSITION.—Ginger was analyzed in 1817 by Bucholz,² and in 1823 by Morin.³

Bucholz's Analysis.

Pale yellow volatile oil	1.56
Aromatic, acrid, soft resin	3.60
Extractive, soluble in alcohol	0.65
Acidulous and acrid extractive, insoluble in alcohol	10.50
Gum	12.05
Starch (analogous to bassorin)	19.75
Apothème, extracted by potash (ulmin?)	26.00
Bassorin	8.30
Woody fibre	8.00
Water	11.90

Morin's Analysis.

Volatile oil.
Acrid soft resin.
Resin insoluble in ether and oils.
Gum.
Starch.
Woody fibre.
Vegeto-animal matter.
Osmazome.
Acetic acid, acetate of potash, and sulphur.
The ashes contained carbonate and sulphate of potash, chloride of potassium, phosphate of lime, alumina, silica, and oxides of iron and manganese.

White Ginger 102.31

Ginger.

1. **VOLATILE OIL OF GINGER.**—Is pale yellow, very fluid, lighter than water, odour that of ginger, taste at first mild, afterwards acrid and hot.

2. **SOFT RESIN.**—Obtained by digesting the alcoholic extract of ginger first in water, then in ether, and evaporating the ethereal tincture. The residual resin is yellowish-brown, soft, combustible, has an aromatic odour, and a burning aromatic taste. Is readily soluble in alcohol, ether, oil of turpentine, and hot almond oil.

3. **STARCH.**—Ginger starch consists of thin flat disks, which resemble those of East Indian arrow-root (see *Curcuma angustifolia*) and plantain starch (see *ante*, p. 223).

PHYSIOLOGICAL EFFECTS.—Ginger is one of the aromatic stimulants (see vol. i. p. 253) which possess considerable pungency or acidity. Its dust applied to the mucous membrane of the nostrils acts as an irritant, and provokes sneezing. The rhizome chewed is a powerful sialagogue. The powder mixed with hot water, and applied to the skin, causes a sensation of intense heat and tingling, and slight redness. When taken into the stomach, ginger operates as a stimulant; first, to the alimentary canal; secondly, to the body generally; but especially to the organs of respiration. Like some other spices (the peppers, for instance), it acts as an excitant to the genital organs. Furthermore, it has been said to increase the energy of the cerebral functions. It is less acrid than pepper.

USES.—Its principal consumption is as a *condiment*. Its powers in this way are considerable, while its flavour is by no means disagreeable, and its acidity scarcely sufficient to enable it, when taken with food, to irritate or inflame.

As a *stomachic* and *internal stimulant*, it serves several important purposes. In

¹ Brande, *Dict. of Mat. Med.*

² *Journ. de Pharm.* ix. 253.

³ Gmelin's *Handb. d. Chem.*

enfeebled and relaxed habits, especially of old and gouty individuals, it promotes digestion, and relieves flatulency and spasm of the stomach and bowels. It checks or prevents nausea and griping, which are apt to be produced by some drastic purgatives. It covers the nauseous flavour of many medicines, and communicates cordial and carminative qualities to tonic and other agents. As a *sialagogue*, it is sometimes chewed to relieve toothache, relaxed uvula, and paralytic affections of the tongue. As a *counter-irritant*, I have frequently known a *ginger plaster* (prepared by mixing together powdered ginger and warm water, and spreading the paste on paper or cloth) relieve violent headache when applied to the forehead.

ADMINISTRATION.—*Powdered ginger* may be administered, in doses of from ten grains to a scruple or more, in the form of a pill. Made into a paste with hot water, it may be applied as a *plaster*, as already mentioned.

Preserved ginger (*conditum zingiberis*), though commonly used as a sweetmeat, may be taken with advantage as a medicine to stimulate the stomach. *Ginger lozenges*, *ginger pearls* (commonly termed *ginger seeds*), and *ginger pipe* are useful articles of confectionery, which are frequently of benefit in dyspepsia accompanied with flatulence.

1. **TINCTURA ZINGIBERIS**, L. E. D. [U. S.]; *Tincture of Ginger*.—(Ginger, sliced [in coarse powder, *E. D.*], ʒijss [ʒvii , *D.* (U. S.)]; Rectified Spirit Oij. Macerate for seven [fourteen, *D.*] days, and strain, *L. D.* "Proceed by percolation or digestion, as directed for tincture of cinchona," *E.*)—A very valuable carminative. It is commonly employed as an adjunct to tonic, stimulant, and purgative mixtures. Its dose is fʒj to fʒij . The tincture, made with proof spirit, becomes turbid by keeping, in consequence of the mucilage it contains.

Essence of ginger is prepared as a tincture, except that the quantity of rhizome should be increased. Some preparers of it concentrate the tincture by distilling off part of the alcohol.

2. **SYRUPUS ZINGIBERIS**, L. E. D. [U. S.]; *Syrup of Ginger*.—(Ginger, sliced, ʒijss ; Boiling Distilled Water Oj; Sugar lbijss , or as much as may be sufficient [Rectified Spirit as much as may be sufficient, *L.*]. Macerate the ginger in the water for four hours, and strain; then add the sugar, and dissolve it.—The *Dublin College* directs it to be prepared with Tincture of Ginger fʒj , and Simple Syrup fʒvij . Mix with agitation.)—Used for flavouring. It is scarcely strong enough to be of much value. An extemporaneous syrup may be prepared by adding the tincture of ginger to common syrup. The *Syrupus Zingiberis* of the United States Pharmacopœia is made by adding fʒij of tincture of ginger (prepared with ʒvii of ginger, and Oij, *wine measure*, of alcohol) to a gallon of syrup, and evaporating the alcohol by a water-bath.

3. **INFUSUM ZINGIBERIS**; *Infusion of Ginger*; *Ginger Tea*.—This is a very useful domestic remedy, and is prepared by digesting from ʒj to ʒiv of Ginger in fʒvj of Boiling Water, for two hours. When flavoured, it is employed as a carminative in flatulence, &c., in doses of one or two tablespoonfuls.

4. **CEREVISIA ZINGIBERIS**; *Ginger Beer*; *Ginger Pop*.—For the following excellent formula for the preparation of this popular and agreeable beverage, I am indebted to Mr. Pollock, of Fenchurch Street: "Take of White Sugar lbxx ; Lemon (or Lime) juice fʒxvii ; Honey lbj ; Ginger, bruised, ʒxxij ; Water cong. xvii . Boil the ginger in three gallons of water for half an hour; then add the sugar, the juice, and the honey, with the remainder of the water, and strain through a cloth. When cold, add the white of one egg and fʒss of essence of lemon; after standing four days, bottle. The bottles are to be laid on their sides in a cellar, and the beer is ready for use in about three weeks. If a little yeast be used, the beer is ready in a day or two; but in this case it does not keep well." This yields a very superior beverage, and one which will keep for many months. Lemon-juice may be pur-

chased for sixpence a pint in Botolph Lane, Thames Street. A formula for the preparation of *Ginger Beer Powders* has already been given (see vol. i. p. 523).

76. *Zingiber Cassumunar*, Roxburgh.

Sex. Syst. Monandria, Monogynia.
(*Radix.*)

The root of this plant is "perennial, tuberous, furnished with long, white, fleshy fibres, and jointed like ginger, but much larger; when fresh, of a deep yellow; possessing a strong, not very agreeable, camphoraceous smell, and warm, spicy, bitterish taste," (Roxburgh.) Sir Joseph Banks and Dr. Comb (to whom specimens of it were given) thought that it was the true *cassumunar* of the shops.¹ But the great resemblance of *cassumunar* root to round *zedoary* leads me to think that it is obtained from a species of *Curcuma*.

About the year 1672, Dr. Pechey received from his brother, factor to the East India Company, a root which was called *cassumunar* (variously spelt *casmunar*, *casumunar*, &c.), *rysagone* (or *risagon*), and *bengale* (or *bengalle*).² These names were probably fictitious, and were merely given to conceal the secret of its nature.

This root is still found in the warehouses of some London druggists, who call it *cassumunar root* (*radix cassumunar*), and consider it to be identical with *zerumbet root* (see *Curcuma Zedoaria*). It appears to me to be the *turmeric-coloured zedoary* of Ainslie, the *zedoaria radice lutea* of Breyerius,³ the *tommon besaar* or *tommon lawac* of Rumphius.⁴ It occurs in segments (halves or quarters) of an ovate tuber (which in the dried state must have been about the size of a pigeon's egg), the external surface of which is marked with circular rings and the bases of the root fibres, and is of a dirty turmeric-yellow colour. Internally it is reddish-brown, and has some resemblance, in its colour and pellucidity, to a fresh-fractured surface of Socotrine aloes. Its flavour is warm and aromatic; its odour is somewhat like that of turmeric. It has not been analyzed. Its effects must be similar to those of *zedoary* and ginger. It was at one time used in convulsive and other cerebral diseases,⁵ but has fallen into disuse.

77. *CURCUMA LONGA*, Linn.—THE LONG-ROOTED TURMERIC.

Sex. Syst. Monandria, Monogynia.
(*Rhizoma*, *L. E.*—*Radix*, *D*)

HISTORY.—Turmeric is probably the *κύπερος ἰνδικός* (*Cyperus indicus*) of Dioscorides.⁶ Both he and Pliny⁷ state that this Indian *Cyperus* has the form of ginger, and that, when chewed, it colours the saliva yellow like saffron. The word *curcuma* is derived from *kurkum*, the Persian name for saffron.⁸

BOTANY. Gen. Char.—Tube of the *corolla* gradually enlarged upwards; limb 2-lipped, each 3-parted. *Filament* broad. *Anther* incumbent, with 2 spurs at the base. *Style* capillary. *Capsule* 3-celled. *Seeds* numerous, arillate.—Stemless plants, with palmate tuberous roots. *Leaves* with sheathing petioles, bifarious, herbaceous. *Scape* simple, lateral or central. *Spike* simple, erect, comose, somewhat imbricated at the base with bracts or saccate spathes. *Flowers* dull yellow, 3 to 5 together, surrounded by bracteolæ.⁹

Sp. Char.—*Bulbs* small, and with the numerous, long, *palmate tubers*, inwardly of a deep, orange yellow. *Leaves* long-petioled, broad-lanceolate, of a uniform green (Roxburgh).

Hab.—Much cultivated about Calcutta, and in all parts of Bengal, also in China and Cochin-China. One acre yields about 2000 lbs. of the fresh root.

DESCRIPTION.—The *tubers*, called in the shops *turmeric* (*radix curcumæ*, seu *terra merita*), are of two kinds: one round (*curcuma rotunda*), the other long (*cur-*

¹ Roxburgh, *Asiatic Researches*, vol. xi.

² Pechey, *Some Observations made on the Root Cassumunar, called otherwise Rysagone, imported from the East Indies* [MS. without date, in the library of the Royal Medical and Chirurgical Society of London]; Sir Hans Sloane, *Phil. Trans.* No. 264, p. 580.

³ *Prodromus*, ii. 105.

⁴ *Some Observations made upon the Root called Casmunar, imported from the East Indies*, published by a Doctor of Physic [Dr. Pechey?] in Gloucestershire. London, reprinted in the year 1693.

⁵ Lib. i. cap. iv.

⁶ Royle, *Essay on the Antiquity of Hindoo Medicine*, p. 87.

⁷ Blume, *op. cit.*

⁸ *Herb. Amboyn.* pars 5ta. p. 168.

⁹ *Hist. Nat. lib. xxi. cap. lxx. ed. Valp.*

cuma longa), but both produced on the same plant. The first are round, oval, or ovate, about two inches long, and one inch in diameter, pointed at one end, and marked externally with numerous annular wrinkles. The second are cylindrical, not exceeding the thickness of the little finger; two or three inches long, somewhat contorted, tuberculated. Both kinds are yellowish externally, internally more or less orange-yellow passing into reddish-brown. The fractured surface has a waxy appearance. The odour is aromatic, somewhat analogous to ginger, but peculiar; the taste is aromatic. When chewed, it tinges the saliva yellow. Its powder is orange-yellow. The tubers are frequently worm-eaten.

If a thin slice of turmeric root be examined by the compound microscope, it is seen to consist chiefly of rounded or oblong, yellow, readily separable cells or vesicles, which appear to be filled with a minutely granular matter, and to be contained in an hexagonal cellular tissue. Intermixed with these cells are observed globules of a viscid, oleaginous, orange-coloured liquid. By boiling the slices in rectified spirit, the oleaginous liquid is dissolved, and the cells are deprived of their yellow colour. The colourless cells appear still to be filled with a granular matter. On the addition of iodine, the cells, but not the hexagonal tissue in which they are contained, acquire a dark blue colour, showing their amylaceous nature.

VARIETIES.—Five varieties of turmeric are known in the English market, namely, China, Bengal, Madras, Malabar or Bombay, and Java turmeric. These are readily distinguishable from each other by their external appearance; but if they were sorted according to their resemblance, the China and Java turmeric would be placed in one group, the Madras and Malabar in a second group, and the Bengal in a third.

1. *China Turmeric.*—This sort consists of smooth, plump, round, and long tubers (*curcuma rotunda et longa*, Figs. 225 and 226) of a greenish-yellow hue externally. They yield a bright powder, and on that account are much preferred for medicinal purposes. Hence they fetch a higher price than any other sorts of turmeric. Probably if much of it were brought to market, it would not fetch more than the Bengal sort.

Fig. 225.

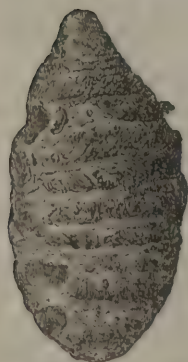
*China round Turmeric.*

Fig. 226.

*China long Turmeric.*

Fig. 227.

*Bengal Turmeric.*

2. *Bengal Turmeric.*—This sort consists of thin or narrow long tubers (*curcuma longa*, Fig. 227) which are moderately smooth externally, and of a grayish dull yellow colour. They break with a deep reddish fracture. Although, from the dull appearance of its narrow tubers, it is not a very inviting sort to the inexperienced

eye, yet it fetches a higher price than the Madras sort, on account of its being a much stronger dye.

3. *Madras Turmeric*.—This is the most showy of all the kinds of turmeric. It consists principally of large long tubers (*curcuma longa*, Fig. 228), but mixed with transverse segments of round tubers (*c. rotunda*, Fig. 229). Externally, the tubers are marked by longitudinal wrinkles, the surface of which is rubbed and bright yellow; internally, the colour is that of a fresh-fractured surface of gamboge.

Fig. 228.



Madras long Turmeric.

Fig. 229.



Madras round Turmeric.

Fig. 230.



Malabar Turmeric.

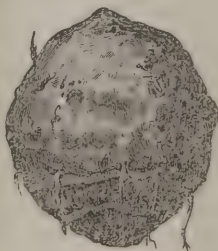
4. *Malabar Turmeric; Bombay Turmeric*.—This sort is not constantly found in the market. It consists principally of long tubers (*c. longa*, Fig. 230); the round tubers (*c. rotunda*) being few and of very inferior quality. This sort of turmeric is smaller and more shrivelled than the Madras sort, but otherwise somewhat resembles it.

Fig. 231.

Fig. 232.



Java Turmeric.



Batavian Turmeric.

5. *Java Turmeric*.—Not frequently found in the English market. In a general way, it may be said to resemble the China sort. It consists of both round and long tubers (*c. rotunda et longa*, Fig. 231), but chiefly the latter. They have a greenish-yellow hue.

Under the name of *bulbs of Batavian turmeric*, I have received a sample of round tubers (Fig. 232) said to be from Java. Dr. Th. Martius notices this sort as having been brought for many years from Batavia, and adds that it contains much colouring matter, and is probably the produce of *Curcuma viridiflora*.

COMPOSITION.—Two analyses of turmeric have been made; one by John,¹ and a second by MM. Vogel and Pelletier.²

¹ Gmelin's *Handb. d. Chem.*

² *Journ. de Pharm.* i. 289.

John's Analysis.		Vogel and Pelletier's Analysis.	
Yellow volatile oil	1	Acrid volatile oil.	
Curcumin	10 to 11	Curcumin.	
Yellow extractive	11 to 12	Brown colouring matter.	
Gum	14	Gum (a little).	
Woody fibre	57	Starch.	
Water and loss	7 to 5	Woody fibre.	
		Chloride of Calcium.	
Turmeric		Turmeric.	
	100		

CURCUMIN. *Yellow Colouring Matter.*—Is obtained, mixed with some volatile oil and chloride of calcium, by digesting the alcoholic extract of turmeric in ether, and evaporating the ethereal tincture to dryness. In the mass, *curcumin* is brownish-yellow, but when powdered it becomes full yellow. It is tasteless, odourless, almost insoluble in water, but readily soluble in alcohol and ether. These properties show that it is of a resinous nature. The alkalis colour it reddish-brown, and readily dissolve it. The alcoholic solution, evaporated with boracic acid, becomes red. Hydrochloric acid, also, reddens it. The alcoholic solution of curcumin produces coloured precipitates with several salts, as acetate of lead and nitrate of silver.

CHEMICAL CHARACTERISTICS.—The alkalis change an infusion of turmeric, or turmeric paper, to reddish-brown. A similar alteration of colour occurs when turmeric paper is exposed to the vapour of hydrochloric acid gas, or is touched with oil of vitriol. If, to tincture of turmeric, boracic acid be added, and the mixture be evaporated to dryness, an orange-red residue is obtained, whereas, without the acid, the residue is yellow. By this test the yellow colouring matter of turmeric can be distinguished from that of rhubarb (see *Rheum*). Sulphate of copper causes a yellowish precipitate with an infusion of turmeric. A similar effect is produced by sesquichloride of iron.

PHYSIOLOGICAL EFFECTS.—Are those of a mild aromatic stimulant (see vol. i. p. 253). The colouring matter becomes absorbed, and communicates a yellow tinge to the urine.¹ According to Mr. Gibson,² the colouring matter of turmeric is somewhat changed by the digestive organs; for the stools of animals fed with this root were green, whilst both logwood and madder exhibited their respective hues after passing through the intestines.

USES.—Employed as a condiment, colouring ingredient, and test. It is a constituent of the well-known *curry powder* and *curry paste*, and of many other articles of Indian cookery. Formerly, it had some reputation in hepatic and other visceral diseases, and especially in jaundice.

As a test, it is used to detect the presence of free alkalis, which change its yellow colour to a reddish-brown.

But alkaline earths and the alkaline carbonates, borates, and sulphurets, as well as boracic and hydrochloric acids, change the colour of turmeric from yellow to brown. Though not a very delicate test, it is often a very useful one.

1. TINCTURA CURCUMÆ; Tincture of Turmeric.—Prepared by digesting one part of bruised Turmeric in six parts of Proof Spirit. Employed for the preparation of turmeric paper. Diluted with water, it yields a slightly turbid yellow liquid, which is sometimes used in the class-room as a test for alkalis, &c.

2. CHARTA CURCUMÆ; Charta exploratoria flava; Turmeric Paper.—Prepared with white, bibulous, or unsized paper, which is to be brushed over with, or soaked in, tincture of turmeric, and dried in the air, the access of alkaline and acid fumes being prevented. Mr. Faraday³ directs it to be prepared with a *decoction of turmeric* (prepared by boiling one ounce of the coarsely-powdered turmeric in ten or twelve ounces of water, straining through a cloth, and allowing the fluid to settle for a minute or two). Turmeric paper is employed as a test for alkalis, &c., which render it reddish or brownish.

¹ Lewis, *Mat. Med.*; and Reiger, quoted by Murray, *App. Med.* vol. v. p. 78.

² *Mem. of the Lit. and Phil. Soc. of Manchester*, vol. i. 2d ser. p. 148.

³ *Chemical Manipulation*.

78. CURCUMA ANGUSTIFOLIA, Roxburgh.—THE NARROW-LEAVED TURMERIC.

Ser. Syst. Monandria, Monogynia.
(Fæcula tuberis. East Indian Arrow-root, Offic.)

HISTORY.—This plant was found by H. T. Colebrook, Esq., in the forests extending from the banks of the Sona to Nagpore, and was by him introduced into the Botanic garden at Calcutta.¹

BOTANY. **Gen. Char.**—Vide *Curcuma longa*.

Sp. Char.—*Bulb* oblong, with pale, oblong, pendulous tubers only. *Leaves* stalked, narrow lanceolate. *Flowers* longer than the bracts.

Hab.—East Indies; from the banks of the Sona to Nagpore (Roxburgh). Also in abundance on the Malabar coast (Ainslie).

EXTRACTION OF THE FECULA.—From the tubers of several species of *Curcuma* is obtained, in the East Indies, a fecula called *tikor*.

According to Dr. Roxburgh,² the biennial roots of the genus *Curcuma* consist of what he calls *bulbs*, *tubers*, and *fibres*. The *bulbs* are formed during the first year, and support the aerial parts of the plants; hence they may be termed *phyllophorous receptacles*. From these bulbs issue the *palmate tubers*, and chiefly the *fibres* or genuine roots; the latter issuing from the lower part of the bulbs. Some of the fibres end in a single oblong, pearl-coloured, solid *tuber*. From these tubers, and from no other parts, the natives of various parts of India obtain starch.

At Bhagulpore this is procured from *C. leucorrhiza*. "The root is dug up, and rubbed on a stone, or beat in a mortar, and afterwards rubbed in water with the hand, and strained through a cloth; the fecula having subsided, the water is poured off, and the *Tikor* (fecula) dried for use."³

At Travancore, and also, according to Bennett,⁴ at Bombay, from the *C. angustifolia*. "So much of it has been made of late years on the Malabar coast, where the plant grows in abundance, that it has become a considerable object in trade, and is much prized in England."⁵

C. rubescens is another species which also yields the fecula called *tikor*.

DESCRIPTION.—*Curcuma starch* (*amylum curcuma*) or *tikor* is imported from the East Indies under the name of *East India arrow-root*. But as this name is also applied to the starch of *Maranta arundinacea*, cultivated in the East Indies, I have thought it advisable to distinguish it by the name of "*Curcuma starch*."

Two kinds of *Curcuma starch* are imported from Calcutta; one white, the other buff-coloured.

a. *White tikor*, or *curcuma starch*, or *white East Indian arrow-root*, is a fine white powder, readily distinguishable, both by the eye and the touch, from West Indian arrow-root. To the eye it somewhat resembles a finely-powdered salt (as bicarbonate of soda or Rochelle salt). When pinched or pressed by the fingers, it wants the firmness so characteristic of West Indian arrow-root, and it does not crepitate to the same extent when rubbed between the fingers.

Examined by the microscope, the particles of this starch are found to be transparent flattened disks of about the $\frac{1}{33}$ th of an inch in thickness.⁶ Their shape is ovate, or oblong-ovate, with a very short neck or nipple-like projection at one extremity, where is situated the part called the hilum. The largest are about $\frac{1}{37}$ th of an inch in length, and $\frac{1}{77}$ th of an inch in breadth.⁷

¹ Roxburgh, *Fl. Indica*, vol. i. p. 31.

² Roxburgh, *Asiatic Researches*, vol. xi. p. 218; also, *Fl. Indica*, vol. i. p. 21.

³ Roxburgh, *Fl. Indica*, vol. i. p. 30.

⁴ Ainslie, *Mat. Indica*, vol. i. p. 19, 1826.

⁵ The particles of plantain-starch, like those of curcuma-starch, are flat disks (see *ante*, p. 223).

⁶ The following measurements, in parts of an English inch, of the particles of East India arrow-root, were made for me by Mr. George Jackson:—

⁷ *Ceylon and its Capabilities*, p. 151.

On account of their flatness they have but little lateral shading, except when viewed edgewise. The hilum or nucleus is placed at the narrow extremity—is circular, very small, and not very distinct. The rings (or rather portions of rings) are seen both on the flat surface and on the edges; they are numerous, close, and very fine.

β. *Buff-coloured tikor, or curcuma starch; pale buff-coloured East Indian arrow-root.*—In the form of powder, or of pulverulent masses, which are dirty or buffy white. Paddy husks, woody fibre, and various impurities, are intermixed.

To the microscope both kinds present the same appearance, from which it is probable that they are obtained from the same plant, but with unequal degrees of care. The particles of East Indian arrow-root are very unequal in size, but on the average are larger than those of West Indian arrow-root.

COMPOSITION.—Not ascertained, but doubtless analogous to that of other starches, viz. $C^{12}H^{10}O^{10}$.

EFFECTS AND USES.—Analogous to those of the West Indian starch. Its commercial value, however, is much below that of the latter. At Travancore, it forms a large portion of the diet of the inhabitants (Roxburgh).

79. Curcuma Zedoaria, Roxburgh.—Round Zedoary.

Sez. Syst. Monandria, Monogynia.

(Tubera.)

Dr. Roxburgh gave some of the dried roots of this plant to Sir Joseph Banks, who ascertained that they agreed well with the *zedoaria rotunda* of the shops.¹

1. ZEDOARIA ROTUNDA.—The *zedoary root (radix zedoaria)* now found in the shops of English druggists is the *round zedoary (zedoaria rotunda)* of pharmacological writers. It occurs in segments (halves, quarters, or flat sections) of a roundish or ovate tuber. The external portion of the tuber is marked by the remains, membranes, and fibres, and is of a pale brownish-gray or whitish appearance. When cut, it presents a yellowish marbled appearance, not very dissimilar to the cut surface of rhubarb. It has a warm, aromatic, bitter taste, and an aromatic odour. It has been analyzed by Bucholz² and by Morin.³ Its constituents, according to the latter chemist, are—volatile oil, resin, gum, starch, woody fibre, *vegeto-animal matter* (?), *osmazome* (?), *free acetic acid*, *acetate of potash*, sulphur, and in the ashes *carbonate and sulphate of potash*, *chloride of potassium*, *phosphate of lime*, *alumina*, *silica*, *oxides of iron and manganese*. It possesses aromatic and tonic properties. It is less heating than ginger and galangal, and is more analogous to turmeric.

2. ZEDOARIA LONGA.—The root called *long zedoary (zedoaria longa)* is no longer found in the shops of English druggists. It is in pieces scarcely so long and wide as the little finger. Its chemical and medicinal properties resemble those of round zedoary. It is, perhaps, the *zerumbet root (radix zerumbet)*, for a piece of which I am indebted to Dr. Royle. It is very similar in shape to a curved or arched piece of long turmeric. Its colour is yellowish-gray.

The plant which yields long zedoary has not been satisfactorily ascertained; but it is probably the *Curcuma Zerumbet* of Roxburgh, who states that the *zerumbet* or *kuchoor* of the native druggists of Calcutta are the roots of this species of *Curcuma*, and that they are principally obtained from Chittagong. He also adds, that he sent the sliced and dried bulbous and palmate tuberous roots to Sir J. Banks, who ascertained that they were the real *zedoaria* of our *Materia Medica*, and that the root of *C. Zedoaria* was the *zedoaria rotunda* of the shops.

3. ZEDOARIA LUTEA.—The *turmeric coloured zedoary* of Ainslie,⁴ the *yellow zedoary (zedoaire jaune)* of Guibourt, is probably the *cassumunar root (radix cassumunar)* of English druggists (see ante, p. 234).

Particles.	Length.	Breadth.	Thickness.
1	0.0027	0.0013	} . . Average 0.0003
2	0.0029	0.0011	
3*.	0.0022	0.0011	
4*.	0.0017	0.0010	
5*.	0.0013	0.0008	
6	0.0012	0.0007	
7	0.0007	0.0004	

¹ Roxburgh's *Flora Indica*, vol. i. pp. 23 and 21.

² *Journ. de Pharm.* t. ix. p. 257.

³ Trommsdorff's *Journal*, xxv. 2, p. 3.

⁴ *Materia Indica*, vol. i. pp. 491 and 493.

80. AMOMUM CARDAMOMUM, Linn.—THE CLUSTER OR ROUND CARDAMOM.

Sex. Syst. Monandria, Monogynia.
(Semina.)

HISTORY.—The fruit of this plant is the *αμωμον* of Dioscorides,¹ the *Amomi uva* of Pliny.²

BOTANY. *Gen. Char.*—*Inner limb of the corolla* one-lipped. *Filament* dilated beyond the anther, with an entire or lobed crest. *Capsule* often berried, 3-celled, 3-valved. *Seeds* numerous, arillate.—*Herbaceous perennials*, with articulated creeping *rhizomes*. *Leaves* in 2 rows, membranous, with their sheaths split. *Inflorescence* spiked, loosely imbricated, radical (Blume).³

Sp. Char.—*Leaves* with short petioles, lanceolate. *Spikes* half immersed in the earth, loosely imbricated with villous, lanceolate, acute, 1-flowered bracts. *Lip*, with the interior margin, 3-lobed. *Crest* 3-lobed (Roxburgh).

Hab.—Sumatra, Java, and other islands eastward to the Bay of Bengal.

DESCRIPTION.—The fruit of this plant is the *round cardamom* (*cardamomum rotundum*) of the shops. It varies in size from that of a black currant to that of a cherry. It is roundish or roundish-ovate, with three convex rounded sides or lobes, more or less striated longitudinally, yellowish or brownish-white, sometimes with a red tint, and when examined by a pocket lens shows the remains of hairs, the greater part of which have probably been rubbed off. The seeds are brown, angular, cuneiform, shrivelled, with an aromatic, camphoraceous flavour. The fruits in their native clusters or spikes (constituting the *Amomum racemosum*) are rarely met with; a fine sample is in the Sloanian collection of the British Museum.

Fig. 233.



Round Cardamom.

COMPOSITION.—It has not been analyzed. Its constituents are probably analogous to those of the Malabar cardamom (*Elettaria Cardamomum*).

EFFECTS AND USES.—Similar to those of the Malabar cardamom. Round cardamoms are rarely employed in this country. They are officinal in the French Codex, and are principally consumed in the southern parts of Europe. The seeds are directed to be used by the Dublin Pharmacopœia, but I presume those of the *Elettaria Cardamomum* are intended.

81. AMOMUM GRANUM PARADISI, Afzelius; et A. MELEGUETA, Roscoe.

Sex. Syst. Monandria, Monogynia.
(Semina.)

HISTORY.—The term "*Malagueta*⁴ pepper" has been applied to the fruit or seeds of several zingiberaceous plants,⁵ as well as to the pimento or allspice.⁶ It is usually considered to be synonymous with the terms "*grains of paradise*," and "*Guinea grains*."

¹ Lib. i. cap. xiv.

² Hist. Nat. lib. xii. cap. xxviii. ed. Valp.

³ Op. cit.

⁴ This word is variously spelt Malagueta, Malaguetta, Melegueta, Mellegetta, Meligetta, &c. Several etymologies of it have been given: some say the seeds have been so called in consequence of their resemblance to Turkey millet, termed by the Italians *melica* or *melega*. Savary says the term is derived from *mala gente*, the designation applied by the Portuguese to the people of the coast yielding the seeds. Another derivation (suggested to me by Mr. R. Thomson, of the London Institution) is *Melli* (also written *Melle* and *Muli*), a kingdom of Nigritia; and *gitti* (or *gitter*), a Portuguese name for pepper. Barbot says the Portuguese word *malagueta* is from the native name for the pepper, *emanegéta*.

⁵ See a paper on "*Grains of Paradise*," by the author, in the *Pharmaceutical Journal*, vol. ii. p. 443, 1843.

⁶ See Ortega, *Historia natural de la Malagueta, o Pimienta de Tavasco*, Madrid, 1780.

Malagueta pepper is said to have been known in Italy before the discovery of the Guinea coast by the Portuguese in the 15th century. It was brought by the Moors, who used to cross the great region of Madingha and the deserts of Lybia, and carry it to Mundi Barca (or Monte da Barca), a port in the Mediterranean. The Italians, not knowing the place of its birth, as it is so precious a spice, called it *grana paradisi*.¹

BOTANY.—The botanical history of these seeds is still involved in some obscurity. Two plants, one called by Afzelius and Smith *Amomum Granum Paradisi*, the other termed by Roscoe *A. Melegueta*, have been said to produce them. But some doubt exists whether these be identical or distinct species. In 1847, in a paper² on Roscoe's *A. Melegueta*, I mentioned that there were slight differences in the appearance of the seeds of the two plants. Since then, I have ascertained that there are two sorts of grains of paradise in the market, and that these are brought from different parts of the African coast, are readily distinguished from each other in trade, and are of unequal commercial value: one of these is identical with the seeds of *A. Granum Paradisi* of Afzelius and Smith, the other with those of *A. Melegueta* of Roscoe.

1. *A. GRANUM PARADISI*, Afzelius, Remed. Guineens. x. n. 1; Nees, Offic. Pflanzen (fig.); *A. Grana-Paradisi*, Smith, Rees's Cyclopæd. vol. xxiii. art. Mellegetta, and vol. xxxix. suppl. art. Amomum.—Guinea coast, about Sierra Leone.

Rhizome perennial, woody, creeping horizontally. *Stems* erect, simple, slender, three feet high, leafy, but destitute of flowers. *Leaves* numerous, crowded, two-ranked, alternate, a span long and an inch broad, lanceolate, or slightly ovate, with a long taper point, entire, smooth, single-ribbed, striated with innumerable oblique veins. Their flavour is slightly aromatic, after having been dried 20 years. *Foot-stalks* sheathing, linear, very long, smooth, striated. *Flower-stalks* radical, solitary, an inch or two in length, ascending, clothed with numerous, close, sheathing bracts, all abrupt, ribbed, somewhat hairy and fringed; the lower ones very short; the upper gradually much larger. Of the parts of the flower nothing could be made out in Sir J. Smith's specimens.

[According to Afzelius, the flowers are large and white, and formed like those of *A. excusum*, Sims.] *Capsule* an inch and a half long, half an inch in diameter, oblong, bluntly triangular, scarcely ovate, beaked, of a dark reddish brown, ribbed, coriaceous, rough, with minute deciduous bristly hairs. When broken, it is very powerfully aromatic, even after being kept 20 years, with a peculiar pepper-like flavour, rather too strong to be agreeable. *Seeds* numerous, enveloped in membranes formed of the dried pulp, roundish or somewhat angular, of a shining golden brown, minutely rough or granulated, extremely hot and acrid (Smith).

2. *A. MELEGUETA*, Roscoe, Monandrian Plants, 1828; Pereira, Pharm. Journ., vol. vi. p. 412, 1847.—Cultivated at Demerara: probably from Africa.

Stem erect, six feet high. *Leaves* two-ranked, subsessile, narrow-lanceolate. *Scape* radical, covered at the base with about seven imbricated, ovate, concave, pointed, and somewhat cuspidate bracts. *Calyx* cylindrical, of one leaf, green, spotted with red. *Flowers* cylindrical, expanding in a double border; outer border in three sections, the middle section largest, ovate, the two others linear and opposite; inner lip very large, broad-ovate, crenate, pale yellow at the base, crimson at the margin. *Filament* strong, erect, clavate, terminating in three lobes, middle lobe erect and bifid, the other two pointed and recurved; a pair of hornlets on the filament, near the base of the lip. *Anther* in two lobes, seated in front of the filament, a little below the apex, bright yellow. *Style* erect, tubular, expanding into a dilated stigma or cup, supported at the base

Fig. 234.

*Amomum Granum Paradisi*, Smith.

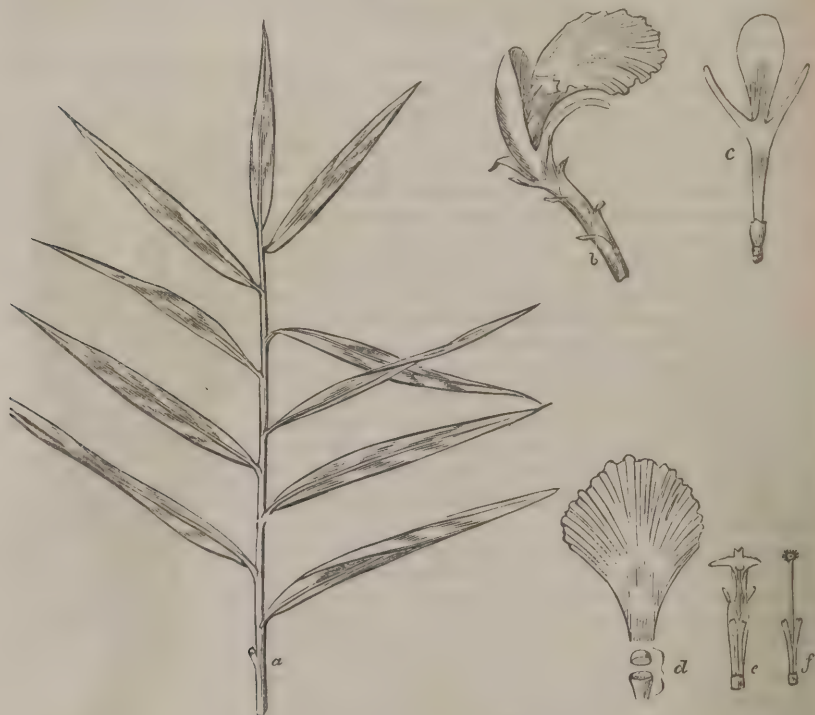
(Natural size. From a specimen in Smith's herbarium in the collection of the Linnæan Society.)

¹ De Barros, quoted in the *Encyclop. Metropol.* art. *Guinea*.

² *Pharmaceutical Journal*, vol. vi. p. 412, 1847.

by two linear processes, about an inch in length, and one-eighth of an inch in breadth, by much the largest specimen of this part observable in any scitamineous plant.

Fig. 235.



Leaves and Flower of Amomum Melegueta, Roscoe.

- a. Stem and leaves.
b. Entire flower and floral bracts.
c. Exterior limb of corolla.

- d. Interior limb of corolla or lip.
e. Filament, anther, stigma, style, and ovary.
f. Style and barren anthers (germinal processes).

Capsule cylindrical, coriaceous, six inches long, yellow, spotted with orange, supported at the base by the large ovate, concave, cuspidate bracts, and containing a columella or receptacle about four inches long, covered with seeds beautifully arranged, arilled, and imbedded in a tomentose substance. Seeds angular, light brown, with a highly aromatic and grateful flavour (Roscoe).

DESCRIPTION. *a. Of the dried fruits.*—I have met with two kinds of dried fruits whose seeds bear the name of grains of paradise or Guinea grains.

1. *Grains of Paradise Fruit* (Fig. 240).—These are oval or oval-oblong capsules, somewhat reddish-brown, and wrinkled longitudinally. Their length (exclusive of stalk and beak) rarely exceeds $1\frac{1}{2}$ inches; and their diameter is about $\frac{1}{2}$ an inch. The seeds agree with the grains of paradise brought from Cape Palmas and Sierra Leone. I am indebted to Dr. Daniell for specimens gathered from the high lands on the right of the River Congo. Some of them are strung on a cord; the usual form in which they are sold in Africa.—These fruits appear to me to agree with the Grain of Paradise *Amomum* described by Afzelius and Smith.

Fig. 236.



Fig. 237.

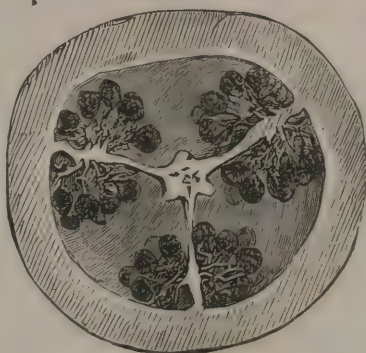


Fig. 238.



Fig. 239.



Fruit of Amomum Melegueta, Roscoe.

Fig. 236. Entire fruit preserved wet.
Fig. 237. Transverse section of ditto.

Fig. 238. Entire fruit dried.
Fig. 239. Seeds of ditto.

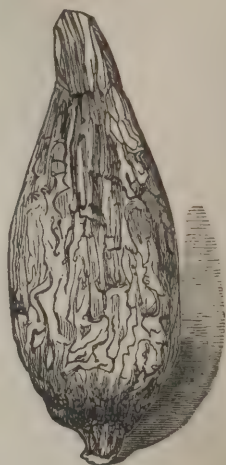
2. *Malagueta Pepper Fruit* (Fig. 241).—These fruits are larger than the preceding, and more ovate. Exclusive of beak and stalk they are two inches long, and one inch in diameter. They are ovate or ovate-oblong, coriaceous, wrinkled as if

Fig. 240.

*Capsule of Grain of Paradise.*

(From Dr. Burgess's collection in the College of Physicians.)

Fig. 241.

*Malagueta Pepper Fruit.*

(From a specimen in the Sloanian collection of the British Museum, where it is labelled "Melegetta—a pod from Guinea.")

shrivelled, yellowish-brown. The seeds are identical with those sold in the shops as grains of paradise or Guinea grains. From the large size of this fruit, I suspect it may be the produce of Roscoe's *A. Melegueta*.

β. *Of the seeds.*—The seeds, called in the shops *grains of paradise* (*grana paradisi*) or *Guinea grains* (*grana guineensia*), are roundish or ovate, frequently bluntly angular, and somewhat cuneiform; shining golden brown; minutely rough, from small warts and wrinkles; internally white. Their taste is aromatic, and vehemently hot or peppery: when crushed and rubbed between the fingers, their odour is feebly aromatic. Their greatest diameter rarely exceeds $1\frac{1}{4}$ line. The acrid taste resides in the seed coats.

Two sorts are distinguished by the importers:—

1. *Guinea grains from Acra.*—These are somewhat larger, plumper, and more warty than the ordinary sort. On the umbilicus of the seeds there is a short, conical, projecting tuft of pale-coloured fibres. This sort fetches a somewhat higher price than the next sort. The seeds agree precisely in appearance with those obtained from Roscoe's *A. Melegueta*.

2. *Guinea grains from Cape Palmas and Sierra Leone.*—Smaller and smoother than the preceding. They are devoid of the projecting fibrous tuft on the umbilicus. Being somewhat cheaper than the foregoing sort, they form the ordinary grains of paradise of the shops. They are perhaps the produce of Afzelius and Smith's *A. Granum Paradisi*.

COMMERCE.—Grains of paradise are imported in casks, barrels, and puncheons, from the coast of Guinea. The quantities on which duty was paid during six years are as follows (*Trade List*):—

In 1835 14,603 lbs.	In 1837 17,134 lbs.	In 1839 19,036 lbs.
1836 16,234	1838 16,199	1840 9,916

"Extract or preparation of Guinea grains" was formerly imported.¹

The heavy duty formerly imposed on grains of paradise was intended to act as a prohibition of their use.²

COMPOSITION.—Grains of paradise were analyzed in 1811 by Willert,³ who obtained the following results: Volatile oil 0.52, acrid resin 3.40, extractive 1.27, tragacanthin and woody fibre 82.8 [? water and loss 12.01].

1. The VOLATILE OIL has a light yellow colour, a camphoraceous smell, and a hot penetrating taste.

2. The RESIN is brown, soft, odourless, and has an acrid burning taste.

PHYSIOLOGICAL EFFECTS.—Analogous to those of pepper. A very erroneous notion prevails that these seeds are highly injurious.⁴

USES.—Rarely employed as an aromatic. Esteemed in Africa as the most wholesome of spices, and generally used by the natives to season their food.⁵

Its principal consumption is in veterinary medicine, and to give an artificial strength to spirits, wine, beer, and vinegar.

By 56 Geo. III. c. 58, no brewer or dealer in beer shall have in his possession or use grains of paradise, under a penalty of £200 for each offence: and no druggist shall sell it to a brewer, under a penalty of £500 for each offence.

82. *Amomum maximum*, Roxburgh.—The Great-winged Amomum.

(Fructus: Java Cardamom, offic.)

HISTORY.—This plant was first described by Roxburgh.⁶

BOTANY. Gen. Char.—Vide *Amomum Cardamomum*.

Sp. Char.—Leaves stalked, lanceolate, villous underneath. Spikes oval, even with the earth. Bracts lanceolate. Lip elliptical. Coronet of one semilunar lobe. Capsules round, 9-winged. (Roxburgh.)

The capsule is "almost globular, size of a gooseberry, 3-celled, 3-valved, ornamented with nine [seven to thirteen, Blume] firm, short, ragged (when old and dry), membranaceous wings. The seeds possess a warm, pungent, aromatic taste, not unlike that of cardamoms, but by no means so grateful." (Roxburgh.) The *Nepal cardamom*, described by Dr. Hamilton,⁷ appears to be identical with the Java cardamom. Dr. Hamilton says, the plant yielding it "is a species of *Amomum*, as that genus is defined by Dr. Roxburgh, and differs very much from the cardamom of Malabar."

Hab.—The Malay Islands (Roxburgh); Java (Blume). Cultivated in the mountainous parts of Nepal, where it is propagated by cuttings of the root [rhizome]; the plants yield in three years, and afterwards give an annual crop (Hamilton).

DESCRIPTION.—The fruit of this plant is known in commerce by various names; such as greater Java cardamoms (*cardamomi majores javanenses*, Th. Martius; Java cardamoms, offic.; Nepal cardamoms, *desi elachi* [i. e. country cardamoms] of Hindustan, Hamilton; the *bura elachee* [i. e. great cardamoms] of Saharunpore—the *bengal cardamoms* of the Calcutta market, Royle; *cardamome ailé de Java* and *cardamome fausse maniguelle*, Guibourt) are oval or oval-oblong, frequently somewhat ovate, three-valved, from eight to fifteen lines long, and from four to eight lines broad, usually flattened on one side, convex on the other, occasionally curved, sometimes imperfectly three-lobed, and resembling in their form the pericarp of the cocoa-nut (Fig. 242). Their colour is dirty grayish-brown. They have a

Fig. 242.



Fig. 243.



Fig. 244.

Java Cardamoms.

Fig. 242. The dried fruit of commerce.

Fig. 243. The fruit which has been soaked in water to expand the wings.

Fig. 244. Seeds.

¹ Frewin, *Digested Abridgment of the Laws of the Customs*, 1519.

² Fourth Report of the African Institution, p. 16.

³ Roseoe, *op. cit.*

⁴ Asiatic Researches, xi. p. 344.

⁵ Trommsdorff's *Journ.* xx. St. 2, 1811.

⁶ Fourth Report of the African Institution.

⁷ An Account of the Kingdom of Nepal, ed. 1819.

coarse, fibrous, aged appearance, are strongly ribbed, and when soaked in hot water (Fig. 243) become most globular, and present from nine to thirteen ragged, membranous wings, which occupy the upper half or three-fourths of the capsule, and are scarcely perceptible in the dried state of the pericarp. By the possession of wings, these cardamoms are distinguished from all others of commerce, and hence might be called the *winged cardamoms*. Occasionally the foot-stalk is attached, with, now and then, portions of brown, membranous, imbricated scales, as long as the fruit. At the opposite or winged extremity of the capsule are frequently the fibrous remains of the calyx. Seeds (Fig. 244) somewhat larger than grains of paradise, dull, dirty brown, with a shallow groove on one side, internally white; taste and odour feebly aromatic. One hundred parts of the fruit consist, according to Th. Martius,¹ of seventy parts seeds, and thirty parts pericarpial coats. They are imported from Calcutta in bags.

COMPOSITION.—Analogous probably to that of the Malabar cardamom, except in the quantity of volatile oil which it yields; for Martius procured only four scruples of it from a pound of the fruit. The oil obtained was white and thickish.

EFFECTS AND USES.—Java cardamoms are not used here. They are of inferior quality, and when brought to this country are usually sold in bond for continental use. In 1839, a quantity of them was sold at seven-pence *per lb.*

83. *Amomum Korarima*.—The Korarima Cardamom.

The fruit of this plant is the *cardamomum majus* of Valerius Cordus,² of Matthioli,³ Geoffroy,⁴ Smith,⁵ and Geiger.⁶ In Dr. Burgess's Collection of *Materia Medica* at the College of Physicians, there are several fine specimens marked "*Cardamomum maximum Matthioli*." (Fig. 245.)

Under the name of *Korarima*, or *Gurâgî* spice, I have received specimens of the same fruit, which had been brought from Abyssinia by Major Harris's embassy, by Dr. Beke, and by Mr. Charles Johnston? (Fig. 246).

In former editions of this work, I followed Sir J. E. Smith,⁸ in considering this fruit to be identical with the *Amomum Madagascariense* of Lamarck,⁹ and the *A. angustifolium* of Sonnerat.¹⁰ As there is some reason to doubt the propriety of this proceeding, I have considered it advisable to designate the plant provisionally the "*Amomum Korarima*;" the word *Korarima* (pronounced in English Korahrêema), being the Galla name for the fruit which in Arabic is called *Khel* or *Khil*.

The capsule is ovate, pointed, flattened on one side, striated, with a broad circular umbilicus or scar at the bottom, around which is an elevated, notched, and corrugated margin. Some authors, who have mistaken the base of the capsule for its summit, have compared the shape to that of a fig.

Some of the fruits which I received from Abyssinia had been perforated and strung upon a cord (Fig. 246), probably for the purpose of hanging them to dry. Dr. Beke thinks that the pierced or perforated fruits are those which have been gathered before they were perfectly ripe.

The seeds (Fig. 247) are rather larger than grains of paradise, roundish or somewhat angular, abrupt at the base, olive-brown, with an aromatic flavour analogous to that of the Malabar cardamom, but totally devoid of the vehemently hot acrid taste of the grains of paradise.

The *Korarima* is brought to the market of Bâso, in southern Abyssinia, from Tûmhe, (known among the native merchants as the "*country of the Korarima*,") somewhere about 9° N. lat. and 35° E. long. It is carried to Massowâh, the port of northern Abyssinia on the Red Sea,

Fig. 245.

Fig. 246.



Fig. 247.

Korarima Cardamom.

Fig. 245. The "*Cardamomum maximum Matthioli*" of Dr. Burgess's collection in the College of Physicians.

Fig. 246. The "*Korarima*," of Dr. Beke.

Fig. 247. Seeds of ditto.

¹ *Pharmakognosie*.

² *Comment. in vi. lib. Diosc. Venet.* 1583.

³ *Rees's Cyclop. art. Mellegetta*.

⁴ *Pharmaceutical Journal*, vol. vi. p. 466, 1847.

⁵ *Encycl. Botan.* t. i. p. 133, Ill. tab. i.

⁶ *Hist. Stirpium*, lib. iv. p. 195, 1361.

⁷ *Mat. Méd.* ii. 366.

⁸ *Handb. d. Pharm.* Bd. ii.

⁹ *Rees's Cyclop.* vol. xxxix. Addenda.

¹⁰ *Voyage aux Indes*, t. ii. p. 242.

and exported from thence to India. Dr. Rüppell was informed that the annual export is of the value of one thousand dollars (about £200 sterling). Although it is not impossible that the same fruit may grow in Madagascar, yet it is highly improbable that the Korarima of Abyssinia is the produce of Madagascar.¹

At Báso, Dr. Beke purchased it at the rate of forty for one penny sterling.

The seeds are aromatic, and possess properties similar to, but more feeble than, those of the Malabar cardamom. In Abyssinia, they are used as a condiment and in medicine.

84. *Amomum citratum*.

Cardamomum majus.—In Dr. Burgess's collection at the College of Physicians is a capsule (in a bad state of preservation) marked "*Cardamomum majus*." It has a fibrous tuft at one extremity, and is much split at the other.

The seeds are angular, oblong, larger than those of Malabar cardamoms, shining brownish-yellow, and have a large concave depression (hilum) at one extremity. They have a warm aromatic flavour, somewhat analogous to that of the oil of lemon-grass. When crushed, they evolve the odour of this oil. Hence I have given them the specific name "*citratum*," as by this character they are readily distinguished from all other seeds of this order with which I am acquainted.

I have found the same fruits in the Sloanian collection of the British Museum. They are tied together in bunches. One sample is unnamed; another is marked in the catalogue "12057. *Grana Paradisi*."

I have met with the same fruits in a collection at Apothecaries' Hall; and I am indebted to Mr. Warrington for the specimen from which Fig. 248 was taken. The capsules are tied together in bunches, as shown in the accompanying figure.

Fig. 248.



Amomum citratum.

Fruits tied together in a bunch—seeds.

85. *Amomum Clusii*, Smith.—Clusius's Cardamom.

Fructus, xiv., Clusius, *Exotic. lib. ii. cap. xv. pp. 37 and 38*; *Grana paradysi sive Mellegetæ affinis fructus*, Bauhin, *Pinax*, p. 413; *Amomum Clusii*, or *Long-seeded Amomum*, Smith, *Rees's Cyclop.* vol. xxxix., *Addenda*.—Capsule ovate, pointed, slightly triangular, cartilaginous, striated, smooth, yellowish [reddish, *Smith*] brown. The seeds have scarcely any flavour, are oblong or ovate, inclining to cylindrical, dark-brown, highly polished, as if varnished; with a pale yellowish brown, corrugated, and notched margin surrounding the scar.

On comparing my specimen (Fig. 249), which was given to me by a druggist, with the one marked *A. Clusii*, in Sir J. E. Smith's collection of fruits in the possession of the Linnean Society, I find the seeds of the latter are somewhat longer, and rather more cylindrical; in other respects, the two specimens agree.

I have subsequently received, from Dr. T. W. C. Martius, specimens of a fruit marked "*Cardamomum maximum von Amomum Clusii?*" The capsules are somewhat plumper, but in other respects they agree with the preceding. I gave one of them to Professor Guibourt, who has published a figure of it.²

I have received from Dr. Daniell specimens of an *Amomum* which greatly resembles, if it be not identical with, *A. Clusii*. The capsules (Figs. 250 and 251), however, are narrower and more tapering than the latter. The seeds (Fig. 252) are obovate, highly polished, smooth, and

¹ Dr. Beke, *Pharmaceutical Journal*, vol. vi. p. 511.

² *Hist. Nat. des Drog.* 4ème édit. t. ii. p. 220, fig. 120, 1849.

dark brown. Are these capsules the produce of *A. Afzelii*? Dr. Daniell¹ says they grow in the thickets at Attapah, on the gold and slave coasts, and plentifully on the outskirts of Clarence and Fernando Po, where they are known under the name of "bastard Melligetta." The seeds

Fig. 250.

Fig. 251.

Fig. 249.

*Amomum Clusii.*

Fig. 252.

Fruits and Seeds of an Amomum from the Western Coast of Africa.

are contained in a soft acidulous pulp of a pleasant flavour, which the natives use in lengthened expeditions to allay thirst, and also as an adjunct to allay the irritative effects of cathartic and other medicines.

86. *Amomum macrospermum*, Smith.—Large-seeded Guinea *Amomum*.

(Semina.)

Zingiber Meleguetta, Gaertner de Fructib. vol. i. p. 34, pl. xii. fig. 1; *Fructus Cajeputi*, Trew. Commmercium Litterarium, ann. 1737, Norimbergæ, p. 129, tab. 1, figs. 7-11; also Herb. Blackwellianum emend. et auctum, vol. iii. cent. vi. tab. 584, figs. 9-13, Norimb. 1773.—Native of Sierra Leone.

The capsule (*fructus cajeputi*, Trew; *cardamomum bandaense*, T. W. C. Martius; *grand cardamome de Gaertner*, Guibourt; *mabooboo* of the natives of Sierra Leone),² is ovate, pointed, somewhat striated, about two inches long, and six lines broad, with a corrugated beak.

¹ *Sketches of the Medical Topography of the Gulf of Guinea*, pp. 111 and 112, 1849.

² Sir J. E. Smith (Rees's *Cyclop. Suppl.*) states, on the authority of Afzelius, that the African name is "Mabooboo." But Nyberg (*Remedia Guineensis*, Upsal, 1813) says that the name "Mabubu" is applied to a species which he calls *Anomum latifolium*, whose seeds, in size, shape, and colour, agree with grape seeds.

The seeds (*semina cajuputi*, Trew) are ovate, or nearly globular, or somewhat oblong, variously angular, scarcely larger than grains of paradise, smooth, polished, greenish-gray, or lead coloured, with a strong umbilicated scar at their base, with a whitish or pale-yellow margin; flavour slightly aromatic. Smith says that Gaertner's figure represents them scarcely half large enough. This statement, however, does not apply to the seeds of my specimens.

The seeds yield, by distillation, a volatile oil. Cartheuser¹ obtained from half a pound of them a drachm and a half of a pale-yellowish, aromatic, camphoraceous oil, resembling, but less fragrant and penetrating than, cajuput oil. Trew erroneously supposed that these seeds were the source of the cajuput oil of commerce, and hence have arisen the erroneous denominations of "*fructus et semina cajuputi*," applied to the fruit and seeds of this species.

The seeds are aromatic, but are much inferior to those of the Malabar cardamom.

I have received from Dr. Daniell specimens of the fruit of this or some closely allied species growing at Gambia and Cape St. Mary. One of the specimens consists of a stalk five inches long, supporting two capsules, and clothed with bracts. The seeds are angular, and lead-coloured. Dr. Daniell tells me that the natives of Africa suck the acidulous pulp of the fruit.

Fig. 253.



Fig. 254.



(From a specimen in the Sloanian collection.)

(Banda cardamom of Martius² and its seeds.)

Amomum macrospermum.

87. *Amomum globosum*, Loureiro?

(Semina.)

Mé tlé, Cochinch.; *Tsão keu*, Chin. Loureiro, Fl. Cochin.—Mountains of Cochinchina and China.

I am indebted to Professor Guibourt for the loan of this fruit, which he calls the *round China cardamom* (*cardamome rond de la Chine*), and from which the accompanying figure was taken.

; Capsule thin, round, or oval. Seeds in globular masses, marked, on the surface opposed to the pericarp, by a linear depression or groove.

I have observed specimens in the Sloanian collection of the British Museum, and also in a collection of Chinese medicines at the College of Physicians.

This fruit may perhaps be the produce of Loureiro's *Amomum globosum*, the seeds of which he says are slightly calefacient and stomachic. They are frequently employed by medical practitioners in China and Cochinchina, and are useful in restraining abdominal pain, sickness, and diarrhœa.

On comparing Professor Guibourt's specimen with the fruit of *Alpinia nutans* (see p. 250) in Dr. Wallich's collection, in the possession of the Linnean Society, the two are scarcely distinguishable externally. The seeds, however, are quite dissimilar.

Fig. 255.

Fig. 256.



Round Cardamom.

Fig. 255. Fruit.

Fig. 256. Globular mass of seeds.

88. *Amomum villosum*, Loureiro?

(Semina.)

Sa ngon, Cochinch.; *Sõ Xá mí*, Chin., Loureiro.—Mountains of Cochinchina.

I am indebted to Professor Guibourt for specimens of a fruit which he calls the *hairy, China cardamom* (*cardamome poilu de la Chine*), and which, in the collection of the Muséum d'Histoire Naturelle, is termed (by mistake?) *tsao keou*.

¹ Dissert. nonnullæ select. Physico-Chem. ac Medicæ, Francof. 1775.

² Professor Guibourt (*Hist. Nat. des. Drog.* 4ème édit. p. 218, fig. 119) has figured one of the specimens given to me by Dr. Martius; but he has erroneously stated that the figure was from a specimen in the Sloanian collection of the British Museum.

Capsules ovate, oblong, obtusely triangular. *Seeds* have no linear depression or groove as those of the preceding variety, and by the absence of this they may be readily distinguished from it; coherent in masses, which are 3-lobed, not quite globular. In my specimens, the pericarp is rugous, as if eroded; but, when examined by a magnifier, it is seen to be covered by asperities and the remains of fine downy hairs. The flavour of the seeds is aromatic and terebinthinate, but not powerful.

Fig. 257.

Fig. 258.



Hairy round China Cardamom.

Fig. 257. Fruit.

Fig. 258. Globular mass of seeds.

Fig. 259.

Black Cardamom
(Guibourt).

spontaneously), to China, where they are largely used in medicine.

BLACK CARDAMOM, Guibourt.—I am indebted to M. Guibourt for a fruit which he calls the *black cardamom* of Gaertner (*cardamome noir* de Gaertner), or the fruit of *Zingiber nigrum*, Gaertner. The capsule is larger than the short Malabar cardamoms, acuminate at its two extremities, and formed, as it were, of two obtusely-triangular pyramids joined base to base. The pericarp ash-brown, aromatic, but less so than the seeds. Seeds annular, brown, slightly aromatic, but devoid of the terebinthinate flavour.

Gaertner states that his plant is the *Alughas* of the Ceylonese. But the black cardamom of Guibourt is certainly not Roxburgh's *Alpinia Allughas*.

89. *Alpinia Galanga*, Linn.; *A. chinensis*, Roscoe (?); and *A. nutans*, Roscoe.

Sex. Syst. Monandria, Monogynia.
(Rhizoma.)

Two kinds of *galangal root* (*radix galangæ*), a lesser and a greater, have long been known in medicine: to these Guibourt has added a third, which he calls *light galangal*. These three sorts are the produce of different parts of the East, and probably of different species of *Alpinia*.

1. *Radix galangæ majoris*; greater or *Java galangal root*.—This is the root of the *Alpinia Galanga*, Linn. It is a coarser and larger root, with a feeble and somewhat different odour from that of the lesser galangal root. Although it occasionally comes to Europe, I cannot learn that it finds any use here.

2. *Radix galangæ minoris*; lesser or *Chinese galangal root*.—This is the root of a plant growing in China, according to Guibourt,¹ the *Alpinia chinensis*, Roscoe (*Hellenia chinensis*, Willd.). It may perhaps be *Alpinia alba*, which Kœnig calls *galanga alba*. It is brought to England from China either directly or by way of Singapore. It is the only sort usually kept by English druggists. It occurs in pieces which are as thick as the finger, seldom exceeding three inches in length, cylindrical or somewhat tuberous, often forked, sometimes slightly striated longitudinally, and marked with whitish circular rings. Externally its colour is dull reddish-brown; internally pale, reddish-white. Its odour is agreeably aromatic; its taste peppery and aromatic. It has been analyzed by Bucholz² and by Morin.³ The former obtained *volatile oil* 0.5, *acid soft resin* 4.9, *extractive* 9.7, *gum* 8.2, *bassorin* 41.5, *woody fibre* 21.6, *water* 12.3, *loss* 1.3. It is a warm and agreeable aromatic, and is sometimes administered in the form of infusion in dyspepsia. Its effects, uses, and doses are analogous to those of ginger. It is, however, rarely employed in England—its principal consumption being on the continent.

3. *Radix galangæ levis*; *galanga leger*, Guibourt; *light galangal root*.—This variety, according to M. Guibourt, is characterized by its great lightness; its weight being not more than a third of that of the previous sort. Its epidermis is smooth and shining. It is, perhaps, the root of *Alpinia nutans* (Roscoe), which Dr. Roxburgh⁴ states is odorous, and is sometimes brought to England for *galanga major*.

¹ Guibourt, *Hist. Nat. des Drogues simples*, t. ii. p. 200, 4ème éd. 1849.

² Trommsdorff's *Journal*, xxv. 2, p. 3.

⁴ *Asiatic Researches*, vol. xi. p. 318.

³ *Journ. de Pharm.* ix. p. 257.

90. *Alpinia alba*, Roscoe.

(Semina.)

Hellenia alba, Willd.; *Heritiera alba*, Retz.; *Lingua vulgaris*, Kœnig; *Amomum medium*, Loureiro, Fl. Cochinch.—The latter gives *Tsão quo* as the Cochinchina name, and *Thao qua* as the Chinese name of the plant.

Specimens of this fruit are in the Muséum d'Histoire Naturelle of Paris, where they are labelled *tsao-quo*. For my specimens, I am indebted to Professor Guibourt, who calls the fruit the *ovoid China cardamom* (*cardamome ovoïde de la Chine*).

The dried fruit is about the size and shape of a large nutmeg: it is ovoid, from ten to fourteen lines long, and from six to eight lines broad, rather rigid, striated longitudinally, yellowish-brown with a reddish tint [scarlet when recent, Kœnig]. Seeds numerous, very large, pyramidal, brown externally, flavour and odour terebinthinate; albumen white, embryo yellow.

Grows in the province of Yu-nan. The seeds are aromatic, and are used by the natives as a condiment. They are said to be useful in intermittents. Kœnig terms the plant *galanga alba*, and says it is much used among the Malays.

Fig. 260.



Ovoid China Cardamom.

91. *Elettaria Cardamomum*, Maton.—THE TRUE OR OFFICINAL CARDAMOM.

Alpinia Cardamomum, Roxb. L.—*Renealmia Cardamomum*, Rosc.—*Amomum Cardamomum*, D.

Sez. Syst. Monandria, Monogynia.

(Semen, L.—The fruit; *Cardamoma*, Ed.—The seeds, D.)

HISTORY.—A medicine, called Cardamom (*καρδάμμων*), is mentioned by Hippocrates,¹ Theophrastus,² and Dioscorides,³ the first of whom employed it in medicine. But it is now scarcely possible to determine what substance they referred to, as their notices of it are brief and imperfect; though I believe it to have been one of the fruits which we call cardamoms. Pliny⁴ speaks of four kinds of cardamoms, but it is almost impossible to ascertain with any certainty what species he refers to.

BOTANY. Gen. Char.—The same as that of *Amomum*, but the *tube of the corolla* filiform, and the *anther* naked (Blume).

Sp. Char.—*Leaves* lanceolate, acuminate, pubescent above, silky beneath. *Spikes* lax. *Scape* elongated, horizontal. *Lip* indistinctly three-lobed (Blume).

Rhizome with numerous fleshy fibres. *Stems* perennial, erect, smooth, jointed, enveloped in the spongy sheaths of the leaves; from six to nine feet high. *Leaves* subsessile on their sheaths, entire; length from one to two feet. *Sheaths* slightly villous, with a roundish ligula rising above the mouth. *Scapes* several (three or four) from the base of the stems, flexuose, jointed, branched, one to two feet long. *Branches* or *racemes* alternate, one from each joint of the scape, suberect, two or three inches long. *Bracts* solitary, oblong, smooth, membranaceous, striated, sheathing, one at each joint of the scape. *Flowers* alternate, short-stalked, solitary at each joint of the racemes, opening in succession as the racemes lengthen. *Calyx* funnel-shaped, three-toothed at the mouth, about three-quarters of an inch long, finely striated, permanent. *Tube of corolla* slender, as long as the calyx; limb double, exterior of three oblong, concave, nearly equal, pale greenish-white divisions; inner lip obovate, much larger than the exterior divisions, somewhat curled at the margin, with the apex slightly three-lobed, marked chiefly in the centre with purple violet stripes. *Filament* short, erect; *anther* double emarginate. *Ovary* oval, smooth; *style* slender, *stigma* funnel-shaped. *Capsule* oval, somewhat three-sided,

¹ Pages 265, 572, 603, 651, ed. Fœs.

² Lib. i. cap. 5.

³ Hist. Plant. lib. xi. cap. vii.

⁴ Hist. Nat. lib. xii. cap. xxix. ed. Valp.

size of a small nutmeg [!], three-celled, three-valved. *Seeds* many, angular (Roxburgh).

Hab.—Mountainous part of the coast of Malabar.

PRODUCTION.—Cardamoms are produced naturally or by cultivation. Between Travancore and Madura they grow without cultivation,¹ and also at certain places in the hills which form the lower part of the Ghâts in Cadutinada and other northern districts of Malayata.² The cardamoms of the Wynaad, which are esteemed the best, are cultivated: the spots chosen for the cardamom farms are called *Ela-Kandy*, and are either level or gently sloping surfaces on the highest range of the Ghâts after passing the first declivity from their base.³ “Before the commencement of the periodical rains, in June, the cultivators of the cardamom ascend the coldest and most shady sides of a woody mountain; a tree of uncommon size and weight is then sought after, the adjacent spot is cleared of weeds, and the tree felled close at its root. The earth, shaken and loosened by the force of the fallen tree, shoots forth young cardamom plants in about a month’s time.”⁴

The quantity of cardamoms brought for sale at Malabar is about 120, or, according to another account, only 100 candies, from the following places:—

	Candies of 640 lbs.	Candies of 640 lbs.
Coorg	40	30
Wynaad	57	65
Tamarachery	20	3
Cadutinada or Cartinaad	3	2
	120	100

The cardamoms of the Wynaad are shorter, fuller of seed, and whiter, than those of Malabar, and sell for 100 rupees a candy more. Those of Coorg have fewer fine grains, but they have also fewer black or light ones. The cardamoms of Sersi (western part of Soonda) are inferior to those of Coorg.⁶

DESCRIPTION.—The fruit of the *Elettaria Cardamomum* constitutes the *small, officinal Malabar cardamom* (cardamoms, Ed.; *cardamomum minus*, Clusius, Matthioli, Bontius, Geoffroy, Dale, Geiger, Th. Martius, and Guibourt; *cardamomum malabarensis*). It is an ovate oblong, obtusely triangular capsule, from three to ten lines long, rarely exceeding three lines in breadth; coriaceous, ribbed, grayish or brownish yellow. It contains many angular blackish or reddish-brown rugose seeds (*cardamomum*, L.; *cardamomum excorticatum*, Offic.), which are white internally, have a pleasant aromatic odour, and a warm, aromatic, agreeable taste.⁷ 100 parts of the fruit yield 74 parts of seeds and 26 parts of pericarpial coats.⁸

Three varieties of Malabar cardamoms are distinguished in commerce; viz. *shorts*, *short-longs*, and *long-longs*. The two latter differ from each other in size merely.

α. SHORTS. *Malabar cardamoms*, properly so called; *Petit cardamome* (Guibourt); ? *Wynaad cardamom* (Hamilton); *Prima species Elettari planè rotunda et albicans* (Rheede).⁹—From three to six lines long, and from two to three lines broad; more coarsely ribbed, and of a browner colour, than the other varieties. This is the most esteemed variety.

β. SHORT-LONGS. *Secunda species Elettari oblongior sed vilior* (Rheede).—Differs from the third variety in being somewhat shorter and less acuminate.

γ. LONG-LONGS. *Moyen cardamome* (Guib.): *Tertia species Elettari vilissima et planè acuminata* (Rheede).—From seven lines to an inch long, and from two to three lines broad:

Fig. 261. Fig. 262. Fig. 263.



Malabar Cardamoms.

Fig. 261. Shorts.
Fig. 262. Short-longs.
Fig. 263. Long-longs.

¹ Hamilton [Buchanan]. *Journey through Mysore, Canara, and Malabar*, vol. ii. p. 336.

² Hamilton, *op. cit.*, vol. ii. p. 510.

³ Capt. Dickson, in Roxburgh's *Fl. Indica*.

⁴ Hamilton, *op. cit.*, vol. ii. p. 538, and vol. iii. p. 228.

⁵ For some drawings of the minute structure of the seeds, vide Bischoff's *Handb. d. botanik. Terminal.* tab. xliii. Figs. 1876 and 1954.

⁶ Th. Martius, *Pharmakogn.*

⁷ White, *Trans. of Lin. Soc.* vol. x. p. 237.

⁸ Hamilton, *op. cit.*, vol. ii. p. 538.

⁹ Rheede, pars xi. tab. 4, 5, and 6.

elongated, somewhat acuminate. This, as well as the last variety, is paler and more finely ribbed than var. *a. shorts*. The seeds also are frequently paler (in some cases resembling those of the Ceylon cardamom) and more shrivelled.

The three sorts are brought from Bombay in chests. The shorts are usually the dearest, and fetch from 3d. to 6d. per lb. more than the longs. The long-longs are seldom brought over. From Madras, only long cardamoms (usually short-longs, rarely long-longs) are brought: they are generally packed in bags, and are lighter by weight than the Bombay sort, and usually fetch 3d. per lb. less than the latter.

COMPOSITION.—The small cardamom was analyzed by Trommsdorff in 1834.¹ He obtained the following results: *Essential oil* 4.6, *fixed oil* 10.4, *a salt of potash (malate?)* combined with *a colouring matter* 2.5, *fecula* 3.0, *nitrogenous mucilage with phosphate of lime* 1.8, *yellow colouring matter* 0.4, and *woody fibre* 77.3.

1. **VOLATILE OR ESSENTIAL OIL OF CARDAMOM.**—Is obtained from the seeds by distilling them with water. 50 lbs. of good short Malabar cardamoms yielded, at one operation, about 3½ viss of oil for every lb. of fruit.² It is colourless, has an agreeable odour, and a strong, aromatic, burning taste. Its sp. gr. is 0.943. It is very soluble in alcohol, ether, oils (both fixed and volatile), and acetic acid. It is insoluble in potash-ley. By keeping, it becomes yellow, viscid, and loses its peculiar taste and smell. It then detonates with iodine, and takes fire when placed in contact with concentrated nitric acid. On this oil depend the odour, flavour, and aromatic qualities of the seeds. Its composition is analogous to that of oil of turpentine, being C¹⁰H⁸.

2. **FIXED OIL OF CARDAMOM.**—Is insoluble in alcohol, ether, and the oils, both fixed and volatile. Nitric acid, assisted by heat, reddens it. It has some analogy to castor oil.

3. **STARCH.**—Schleiden says that in these seeds he has discovered amorphous paste-like starch in the cells.

PHYSIOLOGICAL EFFECTS.—The effects of cardamoms are those of a very agreeable and grateful aromatic, devoid of all acidity.

USES.—Cardamoms are employed partly on account of their flavour, and partly for their cordial and stimulant properties. They are rarely administered alone, but generally either as adjuvants or correctives of other medicines, especially of stimulants, tonics, and purgatives.

ADMINISTRATION.—Though cardamoms enter into a considerable number of pharmaceutical compounds, only two preparations derive their names from these seeds. They are the following:—

1. **TINCTURA CARDAMOMI, E. [U. S.]; Tincture of Cardamoms.**—(Cardamom seeds, bruised, 3ivss [3iv, U. S.]; Proof Spirit Oij [Diluted Alcohol, U. S.]. Macerate for seven days [fourteen, U. S.], and strain. "This tincture may be better prepared by the process of percolation in the same way with the tincture of capsicum, the seeds being first ground in a coffee-mill," E.)—This compound is agreeably aromatic. It is used as an adjunct to cordial, tonic, and purgative mixtures. Dose f3j to f3ij.

2. **TINCTURA CARDAMOMI COMPOSITA, L. E. D. [U. S.]; Compound Tincture of Cardamoms.**—(Cardamom seeds bruised, Caraway seeds bruised, of each 3iiss [3ss, D.]; Cochineal, powdered, 3ijss [3ij, D., 3j, E.]; Cinnamon, bruised, 3v [5j, D.]; Raisins [stoned] 3v [E.]; Proof Spirit Oij [Oij, D.]. Macerate for seven [fourteen, D.] days, and filter. "This tincture may also be prepared by the method of percolation, if the solid materials be first beat together, moistened with a little spirit, and left thus for twelve hours before being put into the percolator," Ed. The Dublin College omits the cochineal and raisins. [Take of Cardamom, bruised, six drachms; Caraway, bruised, two drachms; Cinnamon, bruised, five drachms; Raisins, deprived of their seeds, five ounces; Cochineal, bruised, a drachm; Diluted Alcohol two pints and a half. Macerate for fourteen days, express, and filter through paper, U. S.]—This tincture is used for the same purposes and in the same doses as the former preparation, over which it has the advantage of a more agreeable flavour. Moreover, its colour often renders it useful in prescribing.

¹ Journ. de Chim. Méd. t. i. p. 196, 2nde Sér.

² Private information.

92. Elettaria major, Smith.—THE GREATER OR CEYLON Elettaria.

Alpinia Granum Paradisi, Moon.
(Fructus; Ceylon Cardamom, offic.)

HISTORY.—The fruit of this plant was known to Clusius,¹ who has noticed and figured it under the name of the *Cardamomum majus vulgare*.²

BOTANY.—The flower has not yet been described, but the other parts of the plant are so similar to the corresponding parts of *Elettaria Cardamomum*, that I have felt no difficulty in referring this plant to the genus *Elettaria*. Sir James Edward Smith,³ who was acquainted with the fruit only, observes, “we are persuaded they must belong to the same genus as the Malabar Cardamom.”

Gen. Char.—See *Elettaria Cardamomum*, p. 1142.

Sp. Char.—*Capsule* lanceolate oblong, acutely triangular, with flat sides. *Calyx* three-lobed (Smith).

Rhizome with numerous fibres. *Stem* erect, smooth, enveloped by leaf sheaths. *Leaves* sessile on their sheaths, silky beneath, acuminate; the shorter ones lanceolate, the larger ones oblong-lanceolate; breadth 2 to 3 inches, length not exceeding 15½ inches. *Sheaths* about half the length of the leaves,

Fig. 264.



Elettaria major.

with a roundish ligula. *Scape* from the upper part of the rhizome, flexuose, jointed, 9 inches long, branched; the branches alternate, one from each joint of the scape, sub-erect, half an inch long, supporting two or three pedicels of about 3-10ths of an inch. *Bracts* solitary, sheathing at each joint of the scape, withered; partial ones, solitary, ovate, acute. *Flowers* not present. *Capsules* one or two on each branch of the scape, with the permanent calyx attached to them; their characters are described in the text.

The plant from which the above description has been drawn formed part of a collection made for me in Ceylon, by my much lamented friend and pupil, the late Mr. Frederick Saner, Assistant-Surgeon in Her Majesty's 61st regiment. He received it from Mr. Lear, Acting Superintendent of the Royal Botanic Gardens in Ceylon, whose letter, describing it as "*Alpinia* [*Amomum*] *Granum paradisi*," I have in my possession. I presume, therefore, that it is the plant which Mr. Moon,⁴ the former Superintendent of the Gardens, has described under the same name. The following facts favour this conclusion:—

1. Mr. Moon states that its Singalese name is *Ensal*, a term which both Hermann⁵ and Burmann⁶ gave as the native name for cardamon.

2. Mr. Moon states that it is cultivated at Candy. If the real grain of paradise plant were cultivated in Ceylon, it would be somewhat remarkable that its seeds are never exported. Now, I have carefully

examined the list of exports from that island for several years, but the word grain of paradise never once occurs; and all the seeds imported into England under that name, I find, by the Custom-House returns, come from the western coast of Africa. On the other hand, the Ceylon cardamon comes, as its name indicates, from that island.

It is probable, I think, that the plant which yields the grains of paradise of European commerce does not grow in the East; and that writers who have stated otherwise have confounded it with the plant yielding Ceylon cardamon. But the term "grains of paradise" is so truly

¹ *Exoticorum*, lib. i. pp. 186 and 187.

² For further details respecting the history of this cardamon, the reader is referred to a paper by the author, in the *Pharmaceutical Journal*, vol. ii. p. 384, 1842.

³ Rees's *Cyclopædia*, vol. xxxix. art. *Elettaria*.

⁴ *A Catalogue of the Indigenous and Exotic Plants growing in Ceylon*, Colombo, 1824.

⁵ *Musæum Zeylanicum*, p. 66, Ed. 2nda, Lugd. Bat. 1726.

⁶ *Thesaurus Zeylanicus*, p. 54, Amstelæd. 1737.

oriental in its character, that I suspect it was first applied to Ceylon cardamoms—a supposition rendered probable by the much more agreeable flavour of the latter seeds, as well as by the observation of Dale,¹ that grains of paradise were often substituted for the Ceylon cardamom.²

Hab.—Cultivated at Candy.

COMMERCE.—Bertolacci³ says that the Ceylon cardamom is collected chiefly in the Candian territory, and that he was informed it is not indigenous, but was introduced by the Dutch. The quantity exported from 1806 to 1813 inclusive varied from 4½ to 18 can-dies annually. Percival⁴ states that cardamoms grow in the south-east part of Ceylon, particularly in the neighbourhood of Matura. I am informed that occasionally Ceylon cardamoms come from Quillon.

DESCRIPTION.—The *Ceylon cardamom*, or, as it is sometimes termed in English commerce, the *wild cardamom* (*cardamomum zeylanicum*; *cardamomum medium*, Matth. and Geoffr.; *cardamomum majus*, Bont. and Dale; *cardamomum majus vul-gare*, Clusius; *cardamomum majus officinarum*, C. Bauhin; *cardamomum longum*, Th. Martius and Geiger; *grande cardamome*, Guib.), is a lanceolate-oblong capsule, acutely triangular, more or less curved with flat and ribbed sides, about an inch and a half long and one-third of an inch broad. At one extremity we frequently find the long, cylindrical, permanent, three-lobed calyx; at the other, the fruit-stalk, which is sometimes branched. The pericarp is coriaceous, tough, brownish or yellowish ash-coloured, three-celled. The seeds are angular, rugged, have a yellowish-red tinge, a fragrant and aromatic but peculiar odour, and a spicy flavour. The long diameter of the vitellus is parallel to that of the embryo. Th. Martius⁵ says that 100 parts of these fruits yield 71 parts of seeds, and 29 parts of pericarpial coats.

COMPOSITION, EFFECTS, AND USES.—Ceylon cardamoms have not been analyzed. Their constituents, as well as their effects and uses, are doubtless analogous to those of the Malabar cardamom. Their commercial value is about one-third that of the latter. They are chiefly used on the Continent.

ORDER XVIII. ORCHIDÆ, R. Brown.—ORCHIDS.

ORCHIDES, Jussieu.—ORCHIDACEÆ, Lindley.

CHARACTERS.—*Flowers* irregular, gynandrous. *Perianth* adherent (superior), coloured, or rarely herbaceous; its parts arranged in 2 rows. *Column* consisting of the stamens and style consolidated into a central body. *Stamens* 3, the central only being perfect, except in *Cypripedium*, where the central is abortive and the two lateral perfect; *pollen* powdery, or cohering in waxy masses. *Ovary* adherent (inferior), 1-celled, composed of 6 carpels, of which 3 have parietal placenta; *stigmas* usually confluent in a mucous disk. *Capsule* membranous or coriaceous, rarely fleshy. *Seeds* innumerable, without albumen; *embryo* solid. *Roots* fasciculated and fibrous, sometimes with fleshy tubercles. *Leaves* never lobed; their veins usually parallel, very rarely somewhat reticulated. *Stem* sometimes swollen and jointed, forming *pseudo-bulbs*.

PROPERTIES.—See *Salep* and *Vanilla*.

Fig. 265.



Ceylon Cardamoms.

- a a*, The dried capsules of commerce.
b, Transverse section of a capsule.
c c, Seeds.
d, Magnified view of a section of a seed, to show the embryo seated in vitellus (Lindley).

¹ *Pharmacologia*, p. 252, 3tia ed. Lond. 1737.

² It would appear, however, that the term Grain of Paradise is also applied, in Ceylon, to *Alpinia Allughas*. (See Burmann's *Thesaurus*, p. 54; and Sir J. E. Smith, in Rees's *Cyclopædia*, vol. xxxix. art. *Alpinia*.)

³ *Agricultural, Commercial, and Financial Interests of Ceylon*, p. 157, 1817.

⁴ *Account of Ceylon*, 1805.

⁵ *Pharmakognosie*.

93. *Orchis*, Linn.

Sex. Syst. Gynandria, Monandria.

(Radix; Salep.)

The term *salep*¹ (*radix salep*) is applied to the prepared tubercles of several orchideous plants.

1. **ORIENTAL SALEP.**—This is usually imported from the Levant, and is said to be the produce of Turkey, Natolia, and Persia. It consists of small ovoid tubercles, frequently strung on a cord. In 1825–6, salep of the value of 35,000 francs was imported into France from Persia.² Salep is the produce, probably, of different species of *Orchis*. Fraas³ states that the *σαλίπη* or *σαλίπη* of Greece is collected from *O. Morio*, and also from *O. mascula*, *coriophora*, and *undulatifolia*. Dr. Royle thinks that the salep of Cashmere is obtained from a species of *Eulophia*. Caventou⁴ states that the constituents of salep are gum (which does not become coloured by iodine), much bassorin, a little starch, common salt, and phosphate of lime. Others, however, have found an abundance of starch in salep;⁵ and it is probable, therefore, that the quantity varies at different seasons, and is most abundant before the tubercle is exhausted by the nutrition of the stem.⁶

2. **INDIGENOUS SALEP.**—That prepared from *Orchis mascula* is most valued; but the roots of some of the palmated sorts, as *Orchis latifolia*, are found to answer almost equally well. Geoffroy,⁷ Retzius,⁸ and Moul⁹ have each pointed out the method of preparing it. The latter directs the roots to be washed and the brown skin removed by a brush or by dipping the root in hot water and rubbing it with a coarse linen cloth. The roots are then put on a tin plate and placed in an oven heated to the usual degree for six or ten minutes, in which time they will have lost their milky whiteness and acquired a transparency like horn. They are then removed and allowed to dry and harden in the air.

The fresh roots of the orchis contain a peculiar odorous principle (which is almost entirely dissipated by drying), starch, mucilaginous matter, a small quantity of bitter extractive, ligneous matter, salts, and water.

Salep possesses the dietetical properties of the starchy and mucilaginous substances (see *ante*, vol. i. p. 117). Its medicinal properties are those of an emollient and demulcent. It was formerly in repute as an aphrodisiac and restorative, and as a preventive of miscarriage,¹⁰ but it has no claim to these powers. The notion of its aphrodisiac properties seems to have been founded on the doctrine of signatures.

Indigenous salep was recommended by Dr. Thomas Percival¹¹ as a wholesome article of food; and in a medicinal point of view as a restorative, emollient, and demulcent.

Mucilage of salep (*mucilago radidis salep*; *decoctum salep*) is prepared, according to the Hamburg Codex, with 5 grains of powdered salep and 3j of distilled water. Dissolve by boiling and constantly stirring, and strain.

94. *Vanilla*, Swartz.

Sex. Syst. Gynandria, Monandria.

(Fructus.)

HISTORY.—*Vanilla* (so-called from *vainilla* or *baynilla*, the diminutive of *vaina* or *bayna*, a sheath or pod) is said¹² to have been brought to the Continent, as a perfume, about the year 1510. It could not, however, have obtained much attention; for Clusius,¹³ who received it from England in 1602, confesses that he had not seen it before; and he calls it *lobus oblongus aromaticus*. Hernandez¹⁴ describes the vanilla plant under the name of *tlixochitl* or *aracus aromaticus*. The pods were afterwards denominated *benzanelles* quasi *benzionelles*, on account of their benzoin-like odour.¹⁵

BOTANY. Gen. Char.—*Fruit* a long pulpy pod, with round seeds not inclosed in a loose membrane. (Lindley.)

¹ The term *saloop* is sometimes applied to sassafras tea.

² Chevalier, *Journ. de Pharm.* xv. 536, 1829.

³ *Ann. Chim. Phys.* xxxi. 345.

⁴ *Journ. de Pharm.* xii. 201, 1826; Pfaff, *Syst. d. Mat. Méd.* i. 131; vi. 90.

⁵ Raspail, *Chimie Organique*.

⁶ *Swedish Transactions*, 1764.

⁷ *Synopsis Plant. Fl. Classicæ*, p. 279, 1545.

⁸ *Hist. de l'Acad. Royale des Sciences*, 1740.

⁹ *Phil. Trans.* vol. lix.

¹⁰ Some Observations made upon the Root called Serapias or Salep, imported from Turkey, shewing its admirable Virtues in preventing Women's Miscarriages, written by a Doctor of Physick in the Countrey to his Friend in London, 1694.

¹¹ On the Preparation, Culture, and Use of the Orchis Root (in the *Essays, Medical and Experimental*, 1773).

¹² Morren, *Annals of Natural History*, vol. iii. p. 1, 1839.

¹³ *Exotic lib.* iii. cap. xviii. p. 72, 1605.

¹⁴ *Rerum Medic. Novæ Hisp. Thesaurus*, p. 38, Romæ, 1651.

¹⁵ Mentzelius, *Index Nomin. Plant.* Berol. 1682.

Species.—Although, until recently, most authors have ascribed the vanilla of commerce to the *V. aromatica* of Swartz; yet the assertion rested upon no certain or known fact, but chiefly upon the belief that *V. planifolia* bore no odoriferous fruit.¹ Morren,² however, by artificial impregnation, obtained fruit from the *V. planifolia*, which, in fragrance and other qualities, vied with the best vanilla of commerce; and it is probable, therefore, that this species yields part at least of the best or Mexican vanilla.

But Schiede³ states that there are four forms of Vanilla in Mexico, which he calls respectively *V. sativa*, *V. sylvestris*, *V. pompona*, and *V. inodora*;⁴ the first two of which he thinks have been confounded under the name of *V. planifolia*. He did not, however, see the flowers of any of these species; and, therefore, it is impossible to characterize them. He likewise mentions a *baynilla de mono* or *monkey vanilla*, which he did not examine; and also a *baynilla mestiza* or *hybrid vanilla*, a fruit intermediate between that of *V. sativa* and *V. sylvestris*.

But although the best vanilla comes from Mexico, there are other sorts which are the produce of other parts of tropical America, and which are certainly not the produce of *V. planifolia*; I shall, therefore, also notice such other species as probably contribute some of the vanilla of commerce.

1. *V. PLANIFOLIA*, Andrews, Bot. Rep. t. 538.—Fruit very long, cylindrical, and very fragrant.—West Indies (Aiton), Mexico (?), and Guatemala (?).—Probably yields the best Mexican Vanilla.—Schiede's *V. sativa* and *V. sylvestris* are perhaps referable to this species:—

α. *V. sativa*, Schiede; *Baynilla mansa* or *cultivated vanilla* of the Mexicans. Leaves oblong, succulent, the floral ones very small; fruits without furrows.—Grows wild; and is also cultivated in Papantla, Misanla, Nautla, and Colipa.—Yields the finest sort of Vanilla. This, probably, is the *La Corriente* or *Current Vanilla* of Desvaux.⁵

β. *V. sylvestris*, Schiede; *Baynilla cimarrona* or *wild vanilla* of the Mexicans. Leaves oblong-lanceolate, succulent, the floral ones very small; fruits with two furrows.—Grows in Papantla, Nautla, and Colipa.—Its fruit is collected in Papantla, and mixed with that of the preceding sort.—According to the information furnished to Desvaux, this form is the same species as the preceding; but, growing wild in the woods, and deprived of the solar rays, it yields a smaller fruit.

2. *V. AROMATICA*, Swartz, in Act. Upsal. vi. 66.—Fruit cylindrical, very long.—South America: Brazil.—Said by Martius to yield the *true vanilla* (*vera siliquæ vanillæ*).

3. *V. GUIANENSIS*, Splitberger, Ann. Scien. Nat., 2de Sér. t. xv. Bot. p. 279, 1841.—Fruit fragrant, 6-8 inches long, three-edged, straight or somewhat falcate; sides 11-15 lines broad, one somewhat convex, two flattish, angles obtuse.—Surinam. Probably yields *La Guayra vanilla*, and the *large vanilla* (*vanille grosse*) of Guiana.

4. *V. PALMARUM*, Lindley, Gen. and Sp. of Orchid. Plants, p. 437; Splitberger, Ann. Scien. Nat., 2de Sér. t. xv. p. 283.—Fruit fleshy, 2 inches long and $\frac{1}{2}$ an inch diameter, cylindrical, or slightly three-faced, obtuse at the extremities, bivalved.—Bahia. Yields a vanilla inferior in fragrance to the preceding.

5. *V. POMPONA*, Schiede; *Baynilla pompona* or *large vanilla* of the Mexicans.—Fruit with two furrows, rich in volatile oil, with an agreeable odour, yet will not dry, but always remains soft, and cannot be transmitted to Europe as an article of commerce. Humboldt⁶ says that it has scarcely any sale on account of its odour. Desvaux observes that it is certainly the vanilla called by some authors *bova* (*vanilla bouffie, tumid or swollen vanilla*), and which is found in French commerce under the name of *vanillon*.

CURING.—The preparation or curing of vanilla varies probably in different places. At Misanla the fruits are sun-dried, and afterwards sweated in blankets; or, when the weather is unfavourable, they are dried by artificial heat.⁷ In some places they are dipped in boiling water, then suspended in the sun to dry, and afterwards oiled.⁸ These different processes have for their object not merely the preservation of the fruits, but the development and preservation of their odour, which is supposed to be effected by a kind of fermentation; for in the fresh state, Aublet says, they have no aroma. The seat of the odour has been variously stated to be in the seeds, the pulp, and the fruit coats: probably all these parts possess it in different degrees.

¹ Plumier, who published a figure of *V. aromatica*, expressly states in his MS., published by Geoffroy (Tract. de Mat. Med. t. ii. p. 363. 1741), that his plant differs from the Mexican species in being inodorous.

² Annals of Natural History, vol. iii. p. 1, 1839.

³ Schlechtendal's *Linnaea*, Bd. iv. S. 573, Oct. 1829; also, *Pharmaceutisches Central Blatt für 1830*, S. 46.

⁴ *V. inodora*, the *baynilla de puerco* or *hog vanilla* of the Mexicans, is, Schiede states, a distinct species, but, being deficient in volatile oil, is not used. Desvaux says that in drying it gives out a disagreeable odour, and from this has obtained the name of "hog" vanilla.

⁵ Ann. Sciences Nat. 3me Ser. Botanique, t. vi. p. 119, 1846.—Desvaux says there are two varieties of *La Corriente*; one of which is well filled with seeds and pulp, and has a fine skin—this is the most esteemed; the other, or *Cuéruda* (leathery), has a thick skin, and, though inferior, is *legitimate* in commerce: it is the *Lee*, *Leq*, or *Leg* of some parts of South America.

⁶ Political Essay on the Kingdom of New Spain, translated by J. Black, vol. iii. p. 26, 1822.

⁷ Desvaux, op. supra cit.

⁸ Aublet, *Hist. des Plantes de la Guiane Française*, t. ii. 1775.

DESCRIPTION.—The dried fragrant fruits of several species of vanilla constitute the *vanilla* or *vanilloes* of the shops (*fructus vel capsula vanilla*; *siliqua vanigliæ vel baniglia*).

Four sorts are known in the English market; viz., the Mexican or Vera Cruz, the Honduras, the La Guayra, and the Brazilian or Bahia. A fifth sort I have received by private hand.

1. *Mexican or Vera Cruz Vanilla*.—Imported from Vera Cruz, tied in bundles of 50 pods, weighing, when of good quality, about $9\frac{1}{2}$ or 10 oz. The heavier the bundle, the better the quality and the greater the value per lb. The bundles come packed in tin cases, each holding 60 bundles. I have met with two varieties:—

a. *Finest Mexican Vanilla*.—This consists of pods which are 7 or 8 inches long, $\frac{1}{2}$ of an inch wide, tapering at the extremities, and curved at the base. They are longitudinally wrinkled, soft, clammy, and dark brown. Their odour is very fragrant, resembling, but being more delicious than, that of balsam of Peru. By keeping they become coated with brilliant acicular crystals, and are then called *crystallized vanilla*.

ß. *Second Mexican Vanilla*.—The pods of this sort are shorter (being about 5 inches long), narrower, drier, paler, and less odorous than the preceding, with only a few isolated or no crystals on them. In other respects this sort agrees with the preceding.

Desvaux states that in Mexico five legitimate sorts of vanilla are distinguished: viz., the *primiera* (the *grande finu* of Humboldt), or the finest; *chica-finu* (the *mancuerna* of Humboldt), or small fine; *sacate*, or middlings; *resacate*, or middling middlings; and *basura*, or the sweepings.

The *puerca* and *pompona* are not considered to be legitimate sorts.

Bourbon Vanilla, according to Bouchardat,¹ differs from Mexican vanilla only in being somewhat smaller, redder, less brown, drier, and less unctuous.

2. *Honduras Vanilla*.—Imported from Honduras. Its value is from 2s. to 4s. per lb. The fruits are cylindrical, or slightly flattened, $3\frac{1}{2}$ or four inches long, $\frac{1}{2}$ l or $\frac{3}{4}$ lbs of an inch in diameter, longitudinally wrinkled, brown, and dry. Their odour is vanilla-like, but feeble, and not of that fragrant kind which characterizes the best vanilla.

3. *La Guayra Vanilla*.—Imported from La Guayra, in Venezuela, in various packages (mostly tins in cases). It is an inferior sort, chiefly used by perfumers, and fetches from 2s. to 4s. per lb.

The fruits are large flattened, or somewhat plano-convex, or obscurely triangulated pods, from 5 to 7 inches long, $\frac{1}{2}$ to $\frac{3}{4}$ of an inch wide, somewhat narrowed at the extremities, a little twisted or curled, longitudinally wrinkled, here and there presenting a somewhat blistered appearance, brown, with a peculiar (sweetish fruity) vanilla odour. On the flattened side, at each edge, is a more or less distinct welt-like suture.

In the Museum of the Pharmaceutical Society are two pods, probably of the same sort, received from Mr. Stutchbery, of Demerara. They are, however, $7\frac{1}{2}$ inches long, more distinctly triangular, blackish externally, and appear as if oiled. They were sent along with a pod of what I believe to be *V. guianensis*, preserved wet.

La Guayra Vanilla is probably the produce of *V. guianensis* of Splitberger. It is perhaps the *large vanilla* (*vanille grosse*) of Aublet; and is said by Dr. T. W. C. Martius to be sometimes met with under the name of *vanillon*.

4. *Brazilian or Bahia Vanilla*.—This consists of pods of about $7\frac{1}{2}$ inches long and $\frac{3}{4}$ of an inch wide. The samples which I have seen have been divided longitudinally, and strictly speaking, therefore, are half pods. This sort is blackish, and damp and sticky to the touch, somewhat as if it had been covered with treacle or some glutinous substance. By digestion in spirit it is deprived of its glutinous coating. It is sometimes brought over quite wet. By some persons it is said to have been preserved in sugar, and that to this substance it owes its dampness. Its odour is not equal to that of the best vanilla.

This sort of vanilla corresponds with the fruit neither of *V. aromatica* of Swartz, nor of *V. palmarum*, Lindley—the only two species of vanilla which, according to Martius, are found in the Brazils. Is it *V. pompona* of Schiede?

5. *Panama Vanilla*.—I have received a single pod only of this. It is flat, $3\frac{1}{2}$ inches long, nearly $\frac{3}{4}$ of an inch wide, dark brown, and fragrant.

GOODNESS.—The best vanilla is dark shining brown, plump, heavy, pliant, and soft, and has a fine fragrant smell. The crystallized variety is preferred.

Shrivelled, dull, dry, pale or yellowish brown, faintly smelling, or musty or mouldy pods are bad.

Sometimes dry shrivelled pods are freshened up with balsam of Peru, or are rolled in benzoic acid to give them a crystallized appearance.

COMPOSITION.—The crystallized vanilla was analyzed by Bucholz,² who obtained the following results: Odorous brownish-yellow fixed oil, 10.8; soft resin, scarcely soluble in ether, 2.3; bitter extractive with some acetate of potash, 16.8; acidulous, bitterish, astringent extractive, 9.0; sweet extractive, 1.2; saccharine matter with benzoic acid, 6.1; gum, 11.2; starchy matter,

¹ *Journ. de Pharm.* 3e Sér. t. xvi. p. 274, 1849.

² *Buchner's Repertorium*, Bd. ii. S. 253, 1828.

2.8; woody fibre, 20.0; oxidized extractive dissolved by potash, 7.1; gum extracted by potash, 5.9; benzoic acid, 1.1; water and loss, 5.7.—The ashes of the insoluble fibre consisted of the carbonates of soda, potash, lime and magnesia, sulphate of lime, sulphates, chlorides, alumina, oxide of iron, and oxide of copper.

The nature of the *odorous principle* of vanilla has not been satisfactorily made out. It probably resembles that of the balsam of Peru, and belongs to the cinnamine series. By distillation with water, alcohol, or ether, vanilla yields no volatile oil; the liquid obtained by distillation with water being nearly inodorous. It is said that when the fruit is mature it yields from two to six drops of a liquid which has an exquisite odour, and bears the name of *balsam of vanilla*—none of which, however, reaches Europe, though it is stated to be used in Peru.

The *soft needle like crystals* which incrust the finest kind of vanilla are usually regarded as either benzoic or cinnamic acid. They are slightly soluble in hot water, and the solution, according to my experiments, reddens litmus. Bley,² who examined them, denies that their solution reddens litmus, and considers them to be a peculiar solid volatile oil. They require to be farther examined.

PHYSIOLOGICAL EFFECTS.—Vanilla is an aromatic stimulant. Its effects probably resemble those of balsam of Peru. It is considered to have an exhilarating effect on the mental functions, to prevent sleep, to increase the energy of the muscular system, and to act as an aphrodisiac.³

USES.—As a medicinal agent it is not employed in England. On the continent it has been used in hysteria, melancholia, impotency, asthenic fevers, rheumatism, &c.

Its principal use in this country is to flavour chocolate and various articles of confectionery (ices, creams, &c.), liqueurs, &c. It is also employed in perfumery.

ADMINISTRATION.—It is exhibited in the form of powder or tincture.

1. *Pulvis Vanilla; Powder of Vanilla.*—Vanilla is powdered by the intervention of sugar. The pods being cut in small pieces are pounded in an iron mortar with sugar, then sifted, the residue powdered with more sugar, and so on. The powders are then to be mixed. The quantity of sugar required varies according to the state of dryness or succulency of the pods; but in general four parts of sugar are required for one part of vanilla. This powder is used for aromatizing various culinary and medicinal preparations. It may be administered medicinally in doses of a drachm; equal to about twelve grains of the pure vanilla.

2. *Tinctura Vanilla; Tincture of Vanilla; Essence of Vanilla.*—This is prepared by digesting one part of good Mexican vanilla in six parts of rectified spirit. When inferior sorts of vanilla are used, the proportion of this substance is increased.—Vogler⁴ states that a tincture of balsam of Peru is sometimes substituted for that of vanilla.

2. Leaves with netted (reticulated) veins. *Dictyogens; Retosæ.* Lindley.

† Flowers unisexual, with the perianth adherent to the ovary (*inferior ovary*).

ORDER XIX. DIOSCOREACEÆ, Lindl.—YAMS.

Dioscoreæ, R. Brown.

CHARACTERS.—Twining endogenous plants with reticulated leaves, unisexual regular flowers, a 6-parted superior perianth, 6 stamens, a 3-celled inferior ovary with 1- or 2-seeded cells, and capsular or berried fruit.

PROPERTIES.—See *Dioscorea* and *Tamus*.

95. *Dioscorea, Linn.*—The Yam.

Sex. Syst. Diœcia, Hexandria.

(Tuber.)

In tropical countries (East and West Indies, Africa, Polynesia) the tuberous roots of many species of *Dioscorea* or *Yam*⁵ are used as food. Of seventeen species described by Roxburgh,⁶ eleven are stated to be employed for food. The four following are cultivated in India, and are esteemed in the order in which they are enumerated: *D. globosa*, *D. alata*, *D. purpurea*, and *D. rubella*. Roxburgh also says that *D. atropurpurea* is extensively cultivated at Malacca, Pegu,

¹ An odour more or less allied to that of vanilla, and therefore called the *vanilla odour*, is common to many vegetable substances (see Virey, *Journ. de Pharm.* t. vi. p. 591; also, Mérat and De Lens, *Dict. Mat. Med.* t. vi. p. 843, and Suppl. p. 727.)

² *Pharmaceutisches Central Blatt* für 1831, p. 579.

³ Sundelin, *Heilmittellehre*, ii. 203, 3te Aufl.

⁴ *Pharmaceutisches Central Blatt* für 1848, S. 448.

⁵ The term *yam* is frequently, but erroneously, applied to the tubers of *Tacca* and *Arum* (see ante, p. 157).

⁶ *Fl. Indica*, vol. iii. p. 797.

and the eastern islands; and that *D. fasciculata* is cultivated to a considerable extent in the vicinity of Calcutta, not only for food, but to make starch of the roots. In the West Indies several species are used as food; the chief are *D. aculeata*, *D. alata*, *D. bulbifera*, and *D. sativa*. The tuberous roots sold in the London shops as West India yams are said to be those of *D. alata*.

Yams are large fleshy roots, sometimes weighing from thirty to forty pounds each. Some of them are highly acrid in the fresh state, but become agreeable articles of food when cooked, owing to the dissipation or decomposition of the acrid principle.

The fresh root of *Dioscorea sativa*, from the West Indies, was analyzed by Süersen,¹ who obtained the following results: resin, 0.05; uncrystallizable sugar, 0.26; mucilage, 2.94; starch, 22.66; ligneous fibre, 6.51; nitrogenized matter, quantity undetermined; and water, 67.58. The fresh roots yield 0.52 of ashes, containing carbonate of lime and silica.

The following are the per centage quantities of yam-starch obtained by Dr. Sheir² from the fresh roots of several species of *Dioscorea*:—

Per Centage of Starch.		Per Centage of Starch.	
Common yam (<i>D. sativa</i>)	24.47	Buck yam (<i>D. triphylla</i>)	16.07
Barbados yam (<i>D. ———</i> ?)	18.75	Another sample	15.63
Guinea yam (<i>D. aculeata</i>)	17.03	A third	14.83 (From a dark-coloured variety.)

I am indebted to Dr. Sheir for specimens of the starches of three species: viz., *D. sativa*, *D. aculeata*, and *D. triphylla*. They were prepared in the Colonial Laboratory at Demerara. They are beautifully white, inodorous, and tasteless. Examined by the microscope, the particles of the three starches present a general similarity of character. They are large, somewhat compressed, elliptical or ovate, or somewhat obtusely triangular. They may be compared in shape to the seed of the common scarlet runner bean (*Phaseolus multiflorus*), and are surrounded by rings, which, when viewed on the middle of the flat side of the particle, appear to be but slightly curved. In the latter character they approximate to curcuma starch. Some of the particles present one or two slight nipple-like projections analogous to those of maranta starch. In polarized light, they present the usual crosses observed with most other starches. Their size³ is about $\frac{1}{500}$ th of an inch in length, and about $\frac{1}{700}$ th of an inch in breadth.

Yams are roasted and boiled, and eaten like potatoes. "They are dressed in various forms, being boiled in soups or broths, &c., made into pudding, or roasted in the fire."⁴ Some of them, however, are violently acrid, causing vomiting and diarrhœa, even after being carefully cooked. This is said to be the case with *D. triphylla* and *dæmona*. Yet Dr. Wright and Dr. Sheir declare that the roots of *D. triphylla* are nearly equal to potatoes.

96. *Tamus communis*, Linn.—Common Black Bryonia.

Sex. Syst. Dioecia, Hexandria.
(Radix.)

* *Ἀμπελος μέλαινα*, Dioscor. lib. iv. cap. 185?; *Chironia*, *Gynæcanthe* aut *Apronia*, Pliny, lib. xxiii. cap. 17, ed Valp.?; *Bryonia nigra*, Gerard, 871.—Indigenous. The root (*radix bryoniæ nigæ*) is large and fleshy, black externally, white internally. When fresh, it possesses some acidity. No analysis of it has been made. Taken internally, it acts as a diuretic, and has been esteemed as a lithic (see vol. i. p. 283). It is kept in the herb shops, and sold, like Solomon's seal (see ante, p. 215), as a topical application for removing bruise marks. In France, it is called the *herbe aux femmes battues*, or the herb for bruised women.

¹ Quoted by L. Gmelin, *Handb. d. Chemie*, Bd. ii. S. 1334.

² Report on the Starch-producing Plants of the Colony of British Guiana, by John Sheir, J.L.D. Demerara, 1847.—Dr. James Clark (*Medical Facts and Observations*, vol. vii. 1797) obtained from 4 lbs. of the roots of *D. triphylla* 5 oz. 2 dr. of starch, and from the same quantity of the roots of *D. bulbifera* 8 oz. of starch.

³ The following measurements, in parts of an English inch, of the particles of yam starch, were made for me by Mr. George Jackson:—

Particles.	Guinea Yam.		Common Yam.		Buck Yam.	
	Length.	Breadth.	Length.	Breadth.	Length.	Breadth.
1	0.0025 . . .	0.0020 . . .	0.0019 . . .	0.0012 . . .	0.0030 . . .	0.0015 . . .
2	0.0018 . . .	0.0014 . . .	*0.0019 . . .	0.0009 . . .	*0.0022 . . .	0.0014 . . .
3	*0.0015 . . .	0.0011 . . .	*0.0016 . . .	0.0010 . . .	*0.0017 . . .	0.0010 . . .
4	*0.0012 . . .	0.0010 . . .	0.0012 . . .	0.0008 . . .	*0.0016 . . .	0.0009 . . .
5	*0.0012 . . .	0.0007 . . .	0.0009 . . .	0.0006 . . .	0.0010 . . .	0.0007 . . .
6	0.0010 . . .	0.0006 . . .				
7	0.0013 . . .	0.0005 . . .				

The most prevalent-sized particles are those marked thus *.

⁴ Dr. Wright, *Medicinal Plants growing in Jamaica*, in the *Memoir* of his life, p. 208, 1828.

†† Flowers with the perianth free from the ovary (*superior ovary*).

ORDER XX. SMILACEÆ, *Lindl.*—SARSAPARILLAS.

CHARACTER.—*Flowers* biennial or polygamous. *Calyx* and *corolla* both alike, free, 6-parted. *Stamens* 6, inserted into the perianth near the base; seldom hypogynous. *Ovary* 3-celled, the cells 1 or many-seeded; *style* usually trifid; *stigmas* 3. *Fruit* a roundish berry. *Albumen* between fleshy and cartilaginous; *embryo* usually distant from the hilum.—*Herbaceous* plants or *under shrubs*, with a tendency to climb. *Stems* scarcely woody. *Leaves* reticulated. (*Lindley*.)

PROPERTIES. See *Smilax*.—The *Ripogonum parviflorum*¹ of R. Brown, a native of New Zealand, where it is called *kureao*, is said to possess virtues similar to those of sarsaparilla, and may be termed the *New Zealand sarsaparilla*. The stems yield 12 per cent. of extract, which is bitter, and contains starch-gum and traces of astringent matter.²

97. SMILAX, *Linn.*, several Species of, yielding Sarsaparilla.

Sex. Syst. Diœcia, Hexandria.

(*Sarsa Jamaicensis*; *Smilax officinalis*, *Kunth*? *Radix*, *L.*—*Smilax officinalis*. Jamaica sarsaparilla. The root, *D.*)

HISTORY.—The root of sarsaparilla was brought into Europe from the West Indies, about the year 1530, with the character of being a medicine singularly efficacious in the cure of lues venerea.³ Monardes⁴ says that, when the Spaniards first saw it, they called it *çarça-parilla*, on account of its resemblance to the *çarça-parilla* of Europe (*Smilax aspera*). The Spanish term *zarsaparilla* (from *zarza*, a bramble; and *parilla*, a vine) signifies a thorny vine.

BOTANY. **Gen. Char.**—*Diœcious*. *Perianth* 6-parted, nearly equal, spreading. **MALE FLOWERS:** *stamens* 6; *anthers* erect. **FEMALE FLOWERS:** *perianth* permanent; *ovary* 3-celled, the cells 1-seeded; *style* very short; *stigmas* 3. *Berry* 1- to 3-seeded. *Seeds* roundish; *albumen* cartilaginous; *embryo* remote from the hilum. (*R. Brown*, *Prodrom*. p. 293.)

Species.—Considerable uncertainty prevails as to the botanical origin of the various sorts of sarsaparilla of commerce. From four species of *Smilax*, a great part, at least, of this drug is obtained.

1. *S. OFFICINALIS*, HBK.—*Stem* twining, shrubby, prickly, quadrangular, smooth; the young shoots are unarmed, and almost round. *Leaves* ovate-oblong, acute, cordate, netted, 5- to 7-nerved, coriaceous, smooth, a foot long, and 4-5 inches broad; the young ones are narrow, oblong, acuminate, and 3-nerved. *Petioles* smooth, an inch long, bearing 2 tendrils above the base. *Flowers* and *fruit* unknown.—Grows in New Granada, on the banks of the Magdalena, near Bajorque. It is called *zarsaparilla* by the natives, who transmit large quantities of it to Carthage and Mompox; whence it is shipped for Jamaica and Spain (*Humboldt*).⁵ According to Pohl, it is collected near the river Abaité, in the western part of the province of Minas Geraes (*Martius*).

This species probably yields the sarsaparilla exported from Colombia (*Savanilla*, *Santa Marta*, *Caraccas* and its port *La Guayra*, *St. Margarita* and its port *Porta Arenas*), and Guatemala (*Costa Rica*).

2. *S. MEDICA*, Schlechtendal, in *Linnæa*, vi. 47.—*Stem* angular, armed at the joints with straight prickles, with a few hooked ones in the intervals. *Leaves* shortly acuminate, smooth, 5- to 7-nerved; inferior ones cordate, auriculate-hastate; upper ones cordate-ovate. *Peduncle* axillary, smooth, about an inch long. *Inflorescence*

¹ Allan Cunningham, in *Hooker's Companion to the Botanical Magazine*, vol. ii.

² See a paper, by the author, in the *Pharmaceutical Journal*, vol. v. p. 73.

³ Pearson, *Observations on the Effects of various Articles of the Materia Medica in the Cure of Lues Venerea*, 1800.

⁴ *Clusii Exoticæ*. lib. x. cap. xxii. p. 317.

⁵ *Nov. Gen. et Spec.* i. p. 215.

an 8- to 12-flowered umbel. *Fruit* red, size of a small cherry; contains 1—3 red-dish-brown seeds. *Embryo* cylindrical, lodged in horny albumen (T. F. L. Nees).¹

Schiede² says, that of the numerous species of *Smilax* which grow on the eastern slope of the Mexican Andes, this is the only species which is collected in the villages of Papantla, Tuspan, Nautla, Misantla, &c., and carried to Vera Cruz, from whence it is sent into European commerce under the name of *zarsaparilla*. We may, therefore, safely state that Mexican sarsaparilla (Vera Cruz and Tampico) is the produce of this species.

3. *S. PAPYRACEA*, Poiret; *S. syphilitica*, Mart. (non Humb.) Reise, iii. 1280; *Sipó em* of the natives.—*Stem* 4-cornered or plane-angular, polished, prickly. *Leaves* somewhat membranous, oval-oblong, obtuse at both ends, or usually pointletted at the apex, quite entire, unarmed, 5-ribbed, with 3 more prominent ribs. *Cirrhii* inserted beneath the middle of the petiole.—Province of Rio Negro, in marshy spots on the Japura, near Porto dos Miranhos (Martius); near Ega (Poeppig); and near Borba, in the province of Rio Negro (Riedel).—Yields Brazilian (also called Maranh, Para, or Lisbon) sarsaparilla.

The “Rio Negro Sarsa” of Dr. Hancock³ is perhaps the produce of this species.

The preceding are the species of *Smilax*, from which probably the greater part, if not all, of the sarsaparilla of commerce is obtained. Other species, however, which have been mentioned in connection with this drug, require to be noticed.

4. *S. SARSAPARILLA*, Linn.—It is common in the hedges and swamps of the United States of America; but, notwithstanding its name, it does not yield any of the sarsaparilla of commerce: and there is no evidence that it ever did yield any. Dr. Wood⁴ remarks that its root would certainly have been dug up and brought into the market, had it been found to possess the same properties with the imported medicine.

5. *S. SYPHILITICA*, HBK.—Humboldt and Bonpland discovered it in New Granada, on the river Cassiquiare, between Mandavala and San Francisco Solano.⁵ In the former edition of this work, I stated, on the authority of Martius⁶, that this species yielded Brazilian sarsaparilla. But this botanist has subsequently⁷ ascertained that he had mistaken *S. papyracea* for this species.

Poeppig⁸ states that *S. syphilitica*, HBK., is collected at Maynas (in Colombia), and forms the *sarsa fina* which is mixed with *sarsa gruêsa* (*S. cordato-ovata*, Pers), and sent to Para.

6. *S. CORDATO-OVATO*, Persoon.—Cayenne; Maynas. Yields *sarsa gruêsa* (see *supra*).

7. *S. PURHAMPY*, Ruiz, Memoria sobre las virtudes, &c. &c., Purhampy, p. 65.—Peru. Yields one of the best sorts of sarsaparilla, which Ruiz calls *China peruviana*. Lindley⁹ thinks this may be the same species as *S. officinalis*.

8. *S. OBLIQUATA*, Poiret.—Peru. Guibourt¹⁰ ascribes to this species the *Peruvian sarsaparilla* of commerce, but I know not on what authority.

GENERAL DESCRIPTION.—The *sarsaparilla* or *sarza* (more properly *zárza*) of commerce (*radix sarsaparilla* vel *sarzæ*) consists essentially of the roots of the before-mentioned, and perhaps also of other species of *Smilax*. In some sorts of sarsaparilla the roots are attached to a portion of the *rhizome*.

a. The *rhizome* or *rootstock* (*rhizoma*), called by druggists the *chump*, is a tuberous subterranean stem, which in the living plant is placed horizontally or obliquely in the earth. It grows throwing out aerial stems and roots at the more pointed extremity, and gradually dies off at the thicker and older end. One or more *aerial stems* are frequently found attached to the rhizome of the shops: these are rounded or square, with *nodes* and usually with *aculei* or prickles. If a transverse section be made of either the rhizome or aerial stem, no distinction of bark, wood, and pith is perceptible.

β. The roots (*radices*) are called by Schleiden¹¹ *adventitious* (*r. adventitiæ*): they are usually several feet long, and of variable thickness; on the average about that

¹ Nees, *PJ. Med. Suppl.*

² *Trans. Med.-Bot. Soc.* 1829.

³ *Nova Gen. et Sp. Plant.* t. i. 271.

⁴ *Systema Materiae Medicæ Veg. Brasil.* 1843.

⁵ *Reise in Chile, Peru und auf dem Amazonstrome während der Jahre 1827–32*, Bd. i. S. 459. *Pharm. Central-Blatt.* für 1832, S. 57; and für 1835, S. 908.

⁶ *Flora Medica.*

⁷ *Hist. Nat. des Drog.* t. ii. p. 182, 4ème édit. 1849.

⁸ *Jahresbericht über die Fortschritte in der Pharmacie im Jahre, 1847*, p. 81.

⁹ *Linnaea*, Bd. iv. S. 576, 1829.

¹⁰ *United States Dispensatory.*

¹¹ *Reise in Brasilien*, Bd. iii.

of a writing quill. The thin shrivelled roots are more or less wrinkled or furrowed longitudinally, and in trade are usually said to be *lean*; while the thick, plump, swollen ones are described as being *gouty*. The latter usually abound in starch, and are said to be *mealy*. Frequently, especially in some sorts of sarsaparilla, the roots are said to be *bearded*; that is, they give off, more or less abundantly, fibres, which are themselves often divided into fibrils.

The colour of the roots varies, being more or less red or brown, frequently with a grayish tint. The washed or unwashed condition, the greater or less care taken of them in drying, the time of year when they were collected, the colour and nature of the soil in which they grew, as well as the species or sort of plant from which they are obtained, and many other circumstances, doubtless modify the colour. The taste of the root is mucilaginous, and slightly acid. The acidity is only perceived after chewing the root for a few minutes. The odour is somewhat earthy.

By a transverse section the roots are seen to consist of a cortex or rind, and a ligneous cord or medullium inclosing the pith, somewhat in the manner of an exogenous stem.

The *cortex* or *rind* consists 1st, of the *cuticle* or *epidermis*, composed of compact cells; 2dly, of the *outer cortical layers*, composed of coloured (from golden yellow to deep orange-red), elongated, thick, flattened cells (some of which are porous), which form a *subcuticular tissue* (*epiphlæum* or *periderm*?) ; and, 3dly, of the *inner cortical layers*, consisting of shorter, thinner, cylindrical, often porous cells with large intercellular spaces. In some sorts of sarsaparilla most of these cells abound in starch, while a few contain bundles of acicular crystals (oxalate of lime?) called *raphides*. The mealy cortex is frequently colourless, but sometimes has a roseate tint.

The *ligneous cord* or *medullium* consists of 1st, a *cellular layer* (*liber*?), called by Schleiden the *Kernscheide* or *nucleus-sheath*, whose cells are empty, thick, and strongly coloured (like those of the outer cortical layers); 2dly, a *woody zone*, called by Schleiden the *Gefässbündelkreis* or *vascular-bundle-circle*, usually of a pale yellowish colour, and composed of woody tissue, vessels,¹ and cambial cells; and, 3dly, *medulla* or *pith*, generally colourless, composed of cylindrical cells (like those of the inner cortical layers) which often abound in starch. Sometimes an isolated vessel, or a small group of vessels surrounded by a thin layer of ligneous cells, is seen in the pith.

Fig. 266.

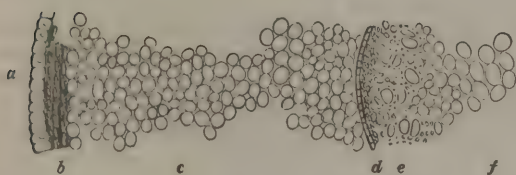


Fig. 266. Transverse section of the cortex and half of the diameter of the medullium.

Fig. 267. Longitudinal section of the cortex.

Fig. 267.



Magnified Sections of Sarsaparilla.

- | | |
|---|---|
| a. Cuticle or epidermis. | d. Cellular layer or nucleus sheath. |
| b. Outer cortical layers (subcuticular tissue). | e. Woody zone (vascular-bundle-circle). |
| c. Inner cortical layers. Most of the cells abound in starch; some few contain raphides (see Fig. 267). | f. Medulla or pith. |

¹ The apertures in the woody zone, seen with the naked eye in a transverse section of the root, are those of large vessels. Occasionally we perceive an isolated bundle of vessels whose interior is filled up with a yellowish-red colouring matter.

The chief anatomical characters, which vary in the different species of sarsaparilla, are the relative breadths of the cortical, ligneous, and medullary layers, the characters of the cells of the nucleus sheath, and the number of layers composing the subcuticular tissue. Schleiden pretends that he can, by these characters, distinguish the South American, Central American, and Mexican sarsaparillas from each other. The following is the way in which he applies them: *South American sarsaparillas*, he says, have, almost without an exception, a mealy cortex and a vascular-bundle-circle whose breadth, from the nucleus sheath to the pith, is one-fourth, or at most one-third, the diameter of the pith. They have, therefore, a large white pith. The *Central American* and *Mexican sarsaparillas* have, on the other hand, a vascular-bundle-circle whose breadth is commonly equal to, and sometimes exceeds, the diameter of the pith. Sometimes, but rarely, the pith is half as thick again as the vascular-bundle-circle. The Central American and Mexican sarsaparillas are, according to Schleiden, readily distinguished from each other by the nucleus sheath, whose cells, in the *Central American* sorts, are either quadrangular or somewhat elongated transversely (tangentially), and are nearly equally thick on all sides (Fig. 268); whereas in the *Mexican* sort these cells are elongated in the direction from within outwards (radially), and have walls which are thicker on the inner than on the outer side (Fig. 269).

Fig. 268.

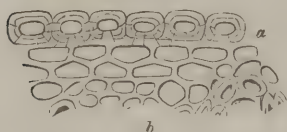
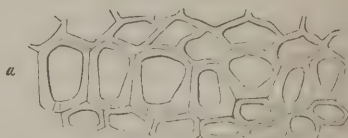


Fig. 269.



Central American Sarsaparilla (Honduras). | South American Sarsaparilla (Vera Cruz).

Magnified Views of the Cells composing the Nucleus Sheath (according to Schleiden).

a, a, a, The cells of the sheath. |

b, A portion of the woody zone.

The Central American and Mexican sorts are less strikingly distinguished, according to Schleiden, by the external cortex (subcuticular tissue), which, in the Central American, consists of only one, rarely two, layers of very thick cells, and altogether has fewer cellular layers; while the Mexican has from 2 to 4 layers of very thick cells, and altogether sometimes 6 or 7 layers.

COMMERCIAL SORTS.—Several sorts of sarsaparilla are met with in commerce, and are well known to our dealers; but I find that, with some exceptions, there is a great want of precision in the names applied to some of the varieties. The terms *Jamaica*, *Lima*, *Honduras*, and *Lisbon* or *Brazilian*, are, by English dealers, applied to sorts which are well known to them either by the characters of the roots or the mode of packing. There is another kind, called by English druggists *gouty* or *Vera Cruz* sarsaparilla, which appears to me to be identical with that called by Continental and American writers *Caraccas sarsaparilla*, under which name I shall describe it.

a. Geographical Classification.—Sarsaparilla is exclusively the produce of America, and grows in the southern part of North America and the northern part of South America. The exact limits are not known.

1. Mexican sarsaparilla.—This is the produce of *Smilax medica*, and is the growth of Papantla, Tuspan, Nautla, Misantla, &c. It is usually shipped at Vera Cruz, and is, therefore, usually known in commerce by the name of *Vera Cruz sarsaparilla*. From Tampico, another Mexican port, a similar sort of sarsaparilla is also exported, which is known in Europe as *Tampico sarsaparilla*. According to Monardes, the first sarsaparilla which came to Europe was brought from New

Spain (Mexico). He describes it as being whiter, somewhat yellowish, and smaller than the Honduras sort.

2. *Central American sarsaparilla*.—Guatemala produces sarsaparilla, which is sometimes exported to Jamaica; but it is not distinguished in European commerce as the produce of Guatemala. *Honduras sarsaparilla* is a well-known and distinct sort in the London market. Monardes says it was the second kind known in Europe. He describes it as darker and thicker than the Mexican sort; and says that it was more esteemed. *Costa Rica sarsaparilla* is usually sold as *Lima sarsaparilla*, with which it agrees in quality. Much sarsaparilla is collected on the Mosquito coast by the Seco Indians, who sell it to the Sambos. The latter carry it in their doreys to Truxillo, where they barter it for goods.¹ I have been informed that sarsaparilla, the produce of the Mosquito Shore of St. Juan de Nicaragua, is sometimes sent to England by way of Jamaica.

3. *Colombian sarsaparilla*.—Since 1831, Colombia has been divided into three independent states, viz., New Granada, Venezuela, and Ecuador, from all of which sarsaparilla is exported to Europe, either directly or indirectly, by way of Jamaica or New York.

a. *New Granada*.—According to Humboldt and Bonpland, sarsaparilla (*Smilax officinalis*) is collected on the banks of the Magdalena, and transmitted to Carthagena and Mompox, whence it is shipped for Jamaica and Spain. Occasionally sarsaparilla is imported into England from Santa Marta and Savanilla.

β. *Venezuela*.—From La Guayra (the sea port of the Caraccas) is shipped to the United States of America and Europe *Caraccas sarsaparilla*. Sarsaparilla is sometimes imported into England from Porta Arenas.

γ. *Ecuador*.—Occasionally sarsaparilla is imported into London from Guayaquil; but whether it is the produce of Maynas or of Central America I know not.

4. *Brazilian sarsaparilla*.—This is a well-known sort, and is imported from Para; and according to Martius is the produce of *Smilax papyracea*. Poeppig, however, says that two sorts of sarsaparilla, *sarsa fina* and *sarsa gruésa*, are collected in Maynas and transmitted to Peru: the first is the produce of *Smilax syphilitica*, the second of *S. cordato-ovata*.

5. *Peruvian sarsaparilla*.—Sarsaparilla is sometimes imported from Lima; but whether it is the produce of Peru or of Maynas, or of Central America, I know not. Under the name of *Lima sarsaparilla* is sold, not only the sarsaparilla from Lima, but also that from Costa Rica. It is probable that no sarsaparilla grows on the western declivity of the Andes, and that the sarsaparilla exported from Lima is either the produce of Maynas or has been carried to Lima from some other ports on the Pacific.

A considerable quantity of sarsaparilla is imported into London from Jamaica (*Jamaica sarsaparilla*), from Valparaiso, and from New York; and formerly also from Lisbon (*Brazilian sarsaparilla*). But it is not the produce of these places.

β. **Qualitative Classification**.—The various commercial sorts of sarsaparilla differ from each other in the anatomical and other characters of the roots, in the manner in which they are folded and packed, and in the absence or presence and character of the attached rhizomes and stalks.

I have already given a sketch of Schleiden's anatomical arrangement of the commercial sorts of sarsaparilla roots. I shall not adopt it, because I do not consider it accurate or easily applied. His classification would associate Costa Rica sarsaparilla with that of Honduras, and the Lima with the Caraccas and Brazilian sorts.

I shall arrange the sarsaparillas of commerce in two divisions: the first including those commonly termed mealy; the second, those which are not mealy.

¹ Young, *Narrative of a Residence on the Mosquito Shore during the Years 1839, 1840, and 1841*, Lond. 1842.

Div. 1. *Mealy Sarsaparillas*.

(Sarsaparillæ farinosæ seu amylaceæ.)

These are characterized by the mealy character of the inner cortical layers, which are white or pale-colored. The meal or starch is sometimes so abundant, that a shower of it, in the form of white dust, falls when we fracture the roots. The thickest mealy coat which I have measured was barely $\frac{1}{10}$ th of an inch in thickness. Compared with the diameter of the medullium or ligneous cord, the thickness of the mealy coat is sometimes nearly equal to it, but usually does not exceed $\frac{1}{3}$ d or $\frac{1}{2}$ of it. The thick mealy roots have a swollen appearance, and are technically called *gouty* by the dealers: the cortex, being brittle, is frequently cracked transversely in rings, and readily falls off. The colour of the mealy coat varies from white to yellowish or pinkish.

Fig. 270.



Magnified view of a section of mealy (Honduras) sarsaparilla.

- a. Cuticle or epidermis.
- b. Outer cortical layers.
- c. Mealy coat, or inner cortical layers.
- d. Cellular sheath.
- e. Woody zone.
- f. Medulla or pith.

The medulla or pith is frequently very amylaceous.

If a drop of oil of vitriol be applied to a transverse section of the root of mealy sarsaparilla, the mealy coat is *but little altered in colour*; while the woody zone becomes dark purplish or almost black. Sometimes the pith also acquires a darkish tint.

A decoction of mealy sarsaparilla, when cold, becomes dark blue on the addition of tincture of iodine.

The aqueous extract of mealy sarsaparilla, when rubbed down with distilled water in a mortar, does not completely dissolve, but yields a turbid liquid, which becomes blue on the addition of iodine.

This division includes three commercial sorts of sarsaparilla; namely, the *Brazilian*, the *Honduras*, and a third kind, which by English dealers is commonly called *gouty* or *Vera Cruz* sort, but which, by Continental and American writers, is usually denominated *Caraccas*.

They may be subdivided thus:—

- | | |
|---|-----------------------|
| A. Pith 2- to 4-times the breadth of the woody layer; cells of the nucleus sheath elongated radially. | |
| a. Pale, folded, often swollen (or gouty) roots with the rhizomes or stems attached | 1. <i>Caraccas</i> . |
| β. Reddish-brown, unfolded roots with rhizomes or stems attached, packed in rolls or cylindrical bundles | 2. <i>Brazilian</i> . |
| B. Pith 1- to 1½ times the breadth of the woody layer; cells of the nucleus sheath square or elongated tangentially | 3. <i>Honduras</i> . |

1. **CARACCAS SARSAPARILLA** (*Radix Sarsaparillæ de Caraccas*).—This is the *gouty* or *Vera Cruz sarsaparilla* of most English dealers. It would appear to come to this country by various routes. One sample, which I have received, came, as I was informed by Mr. Price (of the firm of Price and Gifford, drug brokers), from the Pacific side of South America by way of Valparaiso. Mr. Luckombe, of the firm of Hodgkinson and Co., informs me that some of this sort of sarsaparilla has come by way of New Orleans. Dr. Wood¹ states that it is imported in large quantities into the United States from La Guayra (the port of the Caraccas). He says it comes in oblong packages of about one hundred pounds, surrounded with broad strips of hide, which are connected laterally with thongs of the same material, and leaves much of the root exposed. The roots, he adds, are separately, closely, and carefully packed, and are often very amylaceous internally.

¹ United States Dispensatory.

I have a bundle (Fig. 271) of this sarsaparilla (called by English druggists *gouty* or *Vera Cruz sarsaparilla*) which was imported into Liverpool from Valparaiso. It weighs 5½ lbs. It is flattened, about 2½ feet long, scarcely 1 foot broad at its widest parts, and is 3 or 4 inches thick. At each extremity are two rhizomes, with

Fig. 271.



Bundle of Caraccas Sarsaparilla.

portions of rounded or obscurely square stems bearing a few small prickles. The roots are pale yellowish or reddish-gray, and are very amylaceous. The cells of the nucleus sheath are elongated radially, and their walls are thicker on the inner side (Fig. 269).

This sort is probably the produce of *Smilax officinalis* and *S. syphilitica*, HBK.

Guibourt's *Maracaibo sarsaparilla* is perhaps only a variety of Caraccas sarsaparilla.

2. BRAZILIAN SARSAPARILLA; *Lisbon, Portugal, or Rio Negro Sarsaparilla* (*Radix Sarsaparillæ braziliensis, seu lisbonensis; S. de Maranon; S. de Para; S. insipida*).—Prior to the introduction of the Jamaica sort of sarsaparilla into the London market, the Lisbon sort commanded the highest price.¹ This is usually imported from Para and Maranhão. It is brought over unfolded, tied in rolls or cylindrical bundles (*sarsaparilla longa*) of from three to five feet long, and about a foot in diameter.

In the museum of the Pharmaceutical Society is a roll (Fig. 272) weighing 14½ lbs.: its length is 3 feet 1 inch, and its diameter 7 inches.

Fig. 272.



A Roll of Brazilian Sarsaparilla.

It is free from the rhizome or chump. But, as it is not easy to get at the interior of the rolls, this sort of sarsaparilla is more liable to false packing than any other sort. It has fewer longitudinal wrinkles than the Jamaica kind, fewer radicles, especially at one end; has a reddish-brown colour, and abounds in amylaceous matter, both in the cortex and pith. Its decoction is much paler coloured than the Jamaica variety.

This sort of sarsaparilla is collected on the branches of the Amazon: according to Poeppig, at Huallaga, Intay, Jurua, Rio de los Enganos; according to Martius, at Ucayala, Ica, Jupura, and Rio Negro.

¹ Pope, *Med.-Chir. Trans.* vol. xii. p. 344, 1823.

Martius¹ says that the Indians gather it all the year round, according to the state of the weather and of the rivers. After being dried over a fire, the roots are tied up in bundles with a flexible stem called *Timbotitica*; and to prevent them being worm-eaten, they are preserved in the gables of the houses, where they are exposed to smoke.

The same writer² also states that this sarsaparilla is the produce of *Smilax papyracea* and *S. officinalis*. Poeppig tells us that there are two sorts of sarsaparilla which the dealers mix together; these are *sarsa fina*, a thin, lean sort, less active, but also less liable to be worm-eaten—and *sarsa gruesa*, a thicker, more active sort, but more liable to be attacked by insects: the first, he says, is the produce of *S. syphilitica*, the second of *S. cordato-ovata*. Schleiden suggests that *S. Purhampuy* of Ruiz may perhaps yield some Brazilian sarsaparilla.

3. HONDURAS SARSAPARILLA; *Mealy Sarsaparilla* (*Radix Sarsaparilla de Honduras*; *S. acris* vel *gutturalis*).—It is imported from Belize, and other parts of the Bay of Honduras. It comes in large and smaller bundles, two or three feet long, folded lengthwise (in a kind of hank), and secured in a compact form by a few transverse circular turns. A large bundle (Fig. 273) in the museum of the Pharmaceutical Society is 2½ feet long, from 10 to 12 inches in diameter, and weighs about 17 lbs. A smaller bundle (Fig. 274) is 2 feet 2 inches long, 3½ inches in diameter, and weighs about 2 lbs.

Fig 273.

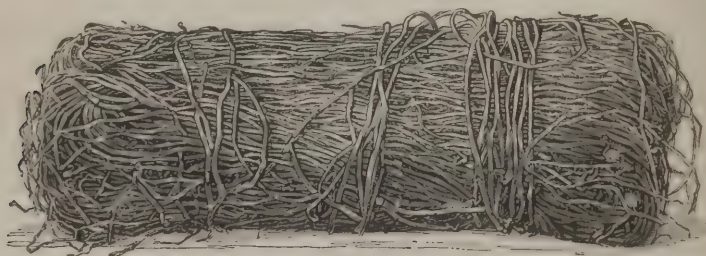
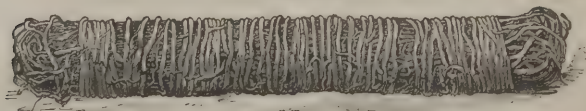


Fig. 274.



Figs. 273 and 274. Large and Smaller Bundles of Honduras Sarsaparilla.

The bundles are packed in bales, weighing from 80 to 110 lbs. or more, and imperfectly covered by skins. In the interior of the bundles are found roots of inferior quality, rhizomes with adherent stems, stones, chumps of wood, &c. The roots are furnished with a few rootlets. The general colour of the roots is dirty grayish or reddish brown. The cortex is very mealy, and the medullium or central cord is thinner than in the Jamaica sort. The cells of the nucleus sheath are square, or are elongated tangentially, and are equally thick on all four sides (see Fig. 268).

The taste of the root is amylaceous, and ultimately somewhat acrid. Its decoction becomes intensely blue by the addition of a solution of iodine. Its powder is fawn-coloured, and, when rubbed with water and tincture of iodine, becomes intensely bluish black. From five pounds of the root of fine quality about one pound of extract may be produced (Hennell). A sample, examined by Mr. Battley, yielded six and a half ounces of extract from three pounds of root, which is

¹ *Reise*, Bd. iii. S. 1260.

² *Systema Mat. Med. Brasil.*

about ten and a half ounces from five pounds: 874 grains of the cortical portions of the root yielded 230 grains of extract (Battley). In one operation, in the laboratory of a friend of mine, 170 lbs. of root yielded 45 lbs. of extract. According to Mr. Pope, the cortex yields twice as much extract as the medullium.

Nothing whatever is known respecting the botanical origin of this sort of sarsaparilla.

Div. 2. *Non-mealy Sarsaparilla.*

(*Sarsaparillæ non-farinosæ vel non-amylacæ.*)

The sarsaparillas of this division are characterized by a deeply coloured (red or brown) usually non-mealy cortex. The cortex is red and much thinner than in the mealy sorts. Although by the microscope starch grains can be detected in the inner cortical layers, yet their number is comparatively small, and is quite insufficient to give the mealiness which characterizes the sarsaparilla of the first division. The diameter of the medullium or ligneous cord is much greater than in the mealy sarsaparillas, and is frequently six or more times greater than the thickness of the cortex. The roots have never that swollen appearance called by dealers gouty, and which is frequently observed in the mealy sorts.

Starch grains are usually recognizable in the pith by the microscope.

If a drop of oil of vitriol be applied to a transverse section of the root of the non-mealy sarsaparillas, both cortex and wood acquire a dark red or purplish tint.

A decoction of non-mealy sarsaparilla, when cold, does not yield a blue colour when a solution of iodine is added to it.

This division includes the sorts known in commerce by the names of *Jamaica* and *Lima* sarsaparillas, as well as a sort which I have received as a *lean Vera Cruz* sarsaparilla.

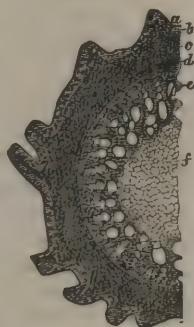
They differ from the Caraccas, Brazilian, and Honduras sarsaparillas, in having a red or brown usually non-mealy cortex. In the relative thickness of the pith and woody layer they agree with the Honduras sarsaparilla; but they differ from it in having the cells somewhat elongated radially, in this respect approaching the Caraccas and Brazilian sorts.

I have been unable to detect any anatomical difference between the roots of the Jamaica, the so-called Lima, and the lean Vera Cruz sorts. The Jamaica and Lima sorts are, I believe, not essentially different from each other. Both are probably the produce of Central America. They differ in colour somewhat, in the mode of packing, and in the route by which they reach England. What I have received as lean Vera Cruz sarsaparilla, might pass for a lean, thin, pale-coloured Lima sort whose roots are unfolded.

4. JAMAICA SARSAPARILLA, offic.; *Red-bearded Sarsaparilla* (*Radix Sarsaparillæ jamaicensis vel rubræ*).—This sort first appeared in the London market about 1819 or 1820.¹ The roots are folded and made up in bundles (*sarsaparilla rotunda*) of about a foot or half a yard long, and four or five or more inches broad. These bundles are neither trimmed nor closely packed.

The bundle from which Fig. 276 was taken, was about 17 inches long,

Fig. 275.



Magnified view of a section of non-mealy (Jamaica) sarsaparilla.

- a. Cuticle or epidermis.
- b. Outer cortical layers.
- c. Red inner cortical layers.
- d. Cellular sheath.
- e. Woody zone.
- f. Medulla or pith.

Fig. 276.

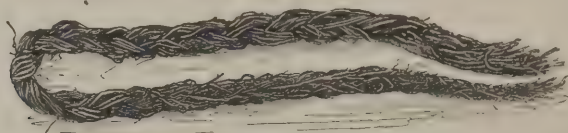


Bundle of Jamaica Sarsaparilla.

¹ Pope, *Med.-Chir. Trans.* vol. xii. p. 344, 1823.

from 5 to 7 inches wide, and 3 inches thick; its weight was $21\frac{1}{2}$ oz. In the museum of the Pharmaceutical Society are some plaits of Jamaica sarsaparilla. One of these (Fig. 277) weighs $5\frac{1}{2}$ ounces, and is $4\frac{1}{2}$ feet long, and $1\frac{3}{4}$ inches wide.

Fig. 277.



A Plait of Jamaica Sarsaparilla.

The bundles of Jamaica sarsaparilla are packed in circular bales of from 60 to 80 lbs. each. The roots of this sort are long, slender, furnished with numerous small fibrous rootlets (called the *beard*). Its cortex is brownish, but with an orange-red tint, which distinguishes it from other kinds of *red* sarsaparilla. The cortex is reddish, and when examined by the microscope is found to contain some starch globules. The medullium has frequently a reddish tint. When chewed, Jamaica sarsaparilla tinges the saliva. Its taste is not remarkably mucilaginous, but slightly bitter, and after a few minutes slightly acrimonious. Its decoction is deepened in colour by a solution of iodine, but no blue is perceptible. Its powder is pale reddish-brown, and when rubbed with water and tincture of iodine becomes blue, but less intensely so than the powder of the Honduras variety. It yields a larger quantity of extract than the other varieties; its extract is perfectly soluble in cold water. From three pounds of average quality about one pound of extract may be obtained (Hennell, also Battley); but from the same quantity of root of very fine quality, nearly one pound and a quarter of extract may be procured (Hennell). 874 grains of the cortical portion of the root yielded 484 grains of extract (Battley). According to Mr. Pope, the cortex yields five times as much as the medullium.

The following are the characters of Jamaica sarsaparilla according to the London Pharmacopœia (1851):—

Reddish, copiously covered with rootlets, with a non-mealy bark.

Jamaica sarsaparilla is not the produce of the island whose name it bears, but, as I have been informed by wholesale dealers, of the Mosquito shore on the eastern coast of Honduras and of St. Juan, from whence it is brought to England by way of Jamaica; and occasionally it is said to be brought from Guatemala.

I am indebted to Mr. G. R. Porter, of the Board of Trade, for the following official account of the sources of Jamaica sarsaparilla:—

Account of the Quantities of Sarsaparilla Imported into Jamaica in each year from 1840 to 1845, distinguishing the Countries from which Imported.

	1840.	1841.	1842.	1843.	1844.	1845.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Guatemala	11,326	—	—	11,176	—	—
Colombia	75,309	11,778	31,442	48,527	143,730	166,148
United States	—	125	80	208	1,210	1,512
Total	86,635	11,903	31,522	59,911	144,940	167,660

The Quantities of Sarsaparilla Exported from Jamaica to Great Britain was—

In 1840	157,868 lbs.	In 1843	27,271 lbs.
1841	19,214	1844	125,738
1842	17,208	1845	175,278

This accords with Humboldt's statement before mentioned (see *ante*, p. 265) that sarsaparilla is exported from Colombia (he says from Carthagen and Mompox) into Jamaica.

But, although this table may be relied on for showing the countries from which sarsaparilla is imported into Jamaica, it does not establish the place of growth.

It is probable that Jamaica sarsaparilla is the produce of *Smilax officinalis*.

In the collection of Materia Medica at Apothecaries' Hall, London, is a sample of sarsaparilla said to have been grown in Jamaica; but it does not resemble the Jamaica sarsaparilla of commerce. Its colour is pale cinnamon brown. Internally it is mealy.

5. LIMA SARSAPARILLA (*Radix Sarsaparillæ de Lima*).—This name is, of course, strictly applicable to sarsaparilla brought from Lima only, from whence, in fact, the first parcels came. But of late years sarsaparilla of the same quality has been brought from various other places; and the dealers, to distinguish it from other kinds, have called it the *Lima sort*; and gradually the term Lima sarsaparilla has been applied, rather to indicate the quality than the place of shipment. The true Lima sort is brought round Cape Horn; whereas much of the so-called Lima sort is the produce of Costa Rica, and is brought from the Caribbean Sea. I know of one importation of 99,000 lbs. from Costa Rica. The Lima sort is also brought from Guajaquil and Valparaiso.

Although some druggists prefer good parcels of Costa Rica to Lima sarsaparilla, still the general run of the Lima parcels comes nearer to Jamaica than the Costa Rica sort. On the whole, however, it is difficult to say whether any dealer can with certainty distinguish the Lima and Costa Rica sorts.

I am informed that the Costa Rica sort sometimes comes from St. Marta, Savanilla, and Caraccas; though that from Costa Rica is usually of a better description.

Lima (including Costa Rica) sarsaparilla is imported folded in bundles or hanks of about 2 or 3 feet long, and 6 or 9 inches in diameter, with the attached rhizome (chump) contained in the interior of the bundle. The bundle, of which a cut (Fig. 278) is subjoined, came *via* Jamaica: it weighed 2 lbs. 13 oz.; was 2 feet long, and 6 inches in diameter.

Fig. 278.



Bundle of Lima Sarsaparilla.

The bundles are usually packed in bales of from 60 to 80 lbs. each.

In quality, Lima sarsaparilla closely resembles the Jamaica sort; but it yields a smaller quantity of extract. Its colour is brown or grayish-brown. Occasionally a few roots are found in a bale of good Lima sarsaparilla, which, as well as their rhizome and stem, are light clay-coloured. The stems are square and prickly: the prickles are few and small, except in the clay-coloured variety.

Lima sarsaparilla is probably the produce of *Smilax officinalis*.

Occasionally a knobby root or rhizome, like the *radix Chinæ*, with a round stem, and long, smooth, wiry, brown root-fibres, is found in a bale of Lima sarsaparilla. A transverse section of the stem presents, to the naked eye, a structure somewhat similar to that of the common cane. I have received the same root (under the name of *Sulsepareille-Squine de Macaraïbo*) from Professor Guibourt, who found it in Caraccas sarsaparilla.

6. VERA CRUZ SARSAPARILLA (*Radix Sarsaparillæ de Vera Cruce*).—Much confusion exists about the sarsaparilla called the Vera Cruz sort; this name being usually applied to the gouty Caraccas sort before described. The sort which I received some years ago under the name of "lean Vera Cruz sarsaparilla," I was

informed came from Vera Cruz; but it is now seldom met with. It is the sort which Mr. Pope¹ described as "lean, dark, and fibrous." The bundle (Fig. 279) is 2 feet long, and, at the widest part, 7 inches broad: the weight is 7 ounces. The roots are unfolded (*sarsaparilla longa*), and have the *chump* attached at one end.

Fig. 279.



Bundle of Vera Cruz Sarsaparilla.

They are thin, tough, of a grayish-brown colour, with a shrivelled, thin, non-mealy cortex. They give off very few rootlets. This sort yields a deep-coloured decoction, which is unchanged by a solution of iodine.

Vera Cruz sarsaparilla is the produce of *Smilax medica*.

Tampico sarsaparilla is probably identical with the Vera Cruz sort.

THERAPEUTICAL VALUE AND QUALITY.—The relative therapeutical values of the different sorts of sarsaparilla are not easily determined. There are only two ways by which we can attempt to arrive at them—one chemical, the other clinical or empirical. But while, on the one hand, we have neither comparative analyses of the various commercial sorts of this root, nor an accurate knowledge of its active principle; so, on the other, we have no clinical observations of the relative effects of the different sorts, and great difficulty exists in the way of making them, on account of the immediate and obvious effects of this root being very slight. To this absence of actual precise information must be ascribed the different relative values assigned to the various sorts in different countries.

In the southern parts of Europe, where sarsaparilla has been the longest in use, the *thickest* and most *mealy* roots, irrespective of the country producing them, are preferred. It is, however, quite certain that starch is not the active principle of the root, but is regarded as being contemporaneous with it. I believe this opinion to be erroneous; for, 1stly, the mealy sarsaparillas give, to the test of oil of vitriol, slighter indications of the presence of smilacin than the non-mealy sorts; 2dly, the mealy sorts are the least acrid to the taste; and, 3dly, the largest quantity of extract is obtained from a non-mealy sort, viz., that brought *via* Jamaica.

In England the non-mealy sarsaparillas are almost universally, and, as I believe, properly preferred; and of these the Jamaica sort is most esteemed, and next to this, that called the Lima.

The *colour* of the root is not to be absolutely depended on, but roots having a deep orange-red tint are preferred. *Taste*, perhaps, is the best criterion: the more acrid and nauseous the taste, the better is the quality of the root. This test has been much insisted on by Dr. Hancock.² The *quantity of extract* yielded by a given weight of the root has been much insisted on by Mr. Battley and Mr. Pope as a test of goodness; both these writers have asserted the superiority of Jamaica sarsaparilla, because it yields a larger quantity of extract. But though a sarsaparilla which yields very little extract cannot be regarded as good, yet it does not follow, especially in the absence of comparative trials, that a sarsaparilla which yields the most abundant extract is necessarily the best, since the quantity may arise from the presence of mucilage and other inert matters. The *beard* is another criterion of goodness: the greater the quantity of root-fibres (technically called *beard*), the better the sarsaparilla.

¹ *Med.-Chir. Trans.* vol. xii. p. 344, 1823.

² *Transactions of the Medico-Botanical Society*, 1829.

COMMERCE.—For the following table I am indebted to Mr. G. R. Porter, of the Board of Trade:—

ACCOUNT, showing the Quantities of Sarsaparilla Imported into the United Kingdom, and distinguishing the Countries from which Imported, in each year from 1840 to 1848.

Countries from which imported.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
France	69	—	15	6	—	—	1	—	4
Portugal	133	—	—	—	4,715	2,099	—	5,872	—
Italy	99	587	—	—	—	3,055	10	—	—
N. American Colonies	—	2	40	—	610	—	—	—	—
West Indies	156,025	46,165	27,575	51,771	136,723	196,715	87,102	49,111	70,480
United States	4,554	56,927	49,236	4,581	39,164	63,701	19,760	41,043	18,067
Mexico	13,828	298	39,694	34,012	12,541	20,683	37,656	—	180
Columbia	94	3,902	—	—	—	—	—	—	—
Brazil	4,141	1,399	5,572	11,736	13,732	23,064	973	5,255	930
Chili	587	1,654	172	5,446	300	—	5,736	—	—
Russia	—	419	—	10,436	—	—	—	407	—
Germany	—	2,725	—	—	—	—	—	—	—
Holland	—	41	—	—	—	—	—	—	—
East Indies	—	5,878	—	—	12	—	—	11,351	—
Guatemala	—	498	16,645	—	—	—	—	—	—
Australia	—	—	—	—	9	105	—	9,878	—
Foreign West Indies .	—	—	—	—	11,518	26,857	—	—	2,862
New Grenada, &c. . .	—	—	—	—	2,018	1,367	47,390	6,996	5,306
Peru	—	—	—	—	145	5,768	13,682	—	—
Spain	—	—	—	—	—	1,659	—	—	—
Cape of Good Hope . .	—	—	—	—	—	13,010	10	—	—
Central America . . .	—	—	—	—	—	134	10,069	161	2,427
Honduras	—	—	—	—	—	—	—	8,004	3,179
Guernsey	—	86	—	—	—	—	—	—	—
Total	180,126	120,581	138,949	128,078	221,487	378,241	222,419	138,078	103,435

COMPOSITION.—Sarsaparilla was analyzed by Cannobio;¹ by Pfaff;² by Batka;³ and by Thubeuf.⁴

Cannobio's Analysis.	Pfaff's Analysis.	Batka's Analysis.	Thubeuf's Analysis.
Bitter acrid resin . . 2.8	Balsamic resin . . . 2.0	1. A crystalline matter (parallinic acid).	1. A crystalline substance (salseparine).
Gummy extractive . . 5.5	Acrid extractive . . . 2.5	2. A colouring (crystalline) matter.	2. A colouring matter.
Starch 54.2	Extractive similar to cinchona 3.7	3. An essential oil.	3. A resinous matter.
Woody fibre 27.8	Common extractive . 9.4	4. Gum.	4. Ligneous matter.
Loss 9.7	Gummy extractive . . 1.4	5. Bassorin.	5. Starch.
Sarsaparilla [Honduras] 100.0	Starch trace	6. Starch.	6. Chloride potassium.
	Albumen 2.2	7. Albumen.	7. Nitrate potash.
	Woody fibre 75.0	8. Extractiform matter.	8. Fixed aromatic thick oil.
	Moisture 3.0	9. Gluten and gliadine.	9. Waxy substance.
	Loss 0.8	10. Fibrous and cellular tissue.	
	Sarsaparilla [Vera Cruz] 100.0	11. Pectic acid.	Sarsaparilla.
		12. Acetic acid.	
		13. Salts—namely, chlorides of calcium, potassium, and magnesium; carbonate of lime, oxide of iron, and alumina.	
		Sarsaparilla.	

Batka⁵ separately analyzed the bark, wood, and pith of Jamaica sarsaparilla, and obtained the following results:—

Epidermis. ⁶	Cortical Pith. ⁷	Woody Nucleus and Pith.
Volatile oil (with some acrid	Starch.	Yellow soft resin.
Colouring matter. [resin].	Gum.	Starch.
Acetates.	Vegetable gluten.	Gum.
Frothing resin (parill-resin, parillinic acid?).	Extractive matter.	Pectates.
Extractive matter.	Albumen.	Vegetable gluten.
Albumen and bassorin.	Resinous colouring matter.	Frothing resin.
Chlorides.	Amylaceous fibre and tegument.	Creasote (a trace).
Starch and gum.		Woody fibre.

¹ Brugnattelli, *Giornale di Fisica*, &c., Dec. 2, vol. i. p. 421, 1818.

² *Syst. de Mat. Med.* Bd. vii. S. 90, 1824.

³ *Ibid.* xx. 682, 1834.

⁴ *Journ. de Pharm.* t. xx p. 43, 1834.

⁵ *Pharmaceutisches Central-Blatt für 1834.* S. 902.

⁶ By epidermis, I presume the author means both epidermis properly so called and the outer cortical layers.

⁷ By cortical pith (*Rindemark*), the author obviously means the inner cortical layers.

1. ESSENTIAL OIL OF SARSAPARILLA.—Sarsaparilla contains a small quantity of volatile oil.

The following experiments were made by a friend, a manufacturing chemist, who gave me the products for examination. 140 lbs of Jamaica sarsaparilla were distilled, by steam heat, at twice, with 220 gallons of water. 50 gallons of a milky liquid were obtained, which were again submitted to distillation until 20 gallons had passed over. 20 lbs. of common salt were added to the distilled product, and heat being applied, 3 gallons were drawn over. The liquor was milky, held in solution carbonate of ammonia, and contained a few drops of a volatile oil, which was heavier than water, was soluble in rectified spirit, and had the odour and acid taste of sarsaparilla. 100 lbs. of Jamaica sarsaparilla were distilled with 100 gallons of water. The distilled liquor was acid, and formed a white precipitate with solutions of acetate of lead. It was re-distilled: the liquor that first passed over was not ammoniacal, but towards the end of the process became so.

2. SMILACIN.—Discovered in 1824 by Palotta,¹ who termed it *pariglin*. Folchi, about the same time, also procured it, and gave it the name of *smilacin*. Thubent, in 1831, called it *salseparin*. In 1833, Batka announced that the active principle of this root was an acid, which he termed *parallinic acid*. Lastly, in 1834, Poggiale² showed the identity of these different substances.

It is procured by decolorizing a concentrated hot alcoholic tincture of sarsaparilla by animal charcoal. The tincture deposits, on cooling, impure smilacin, which may be purified by repeated solution and crystallization. Soubeiran³ has proposed a more economical process.

It resides both in the cortical portion and in the woody zone.

Smilacin is a white, crystallizable, odourless, and, in the anhydrous state, almost tasteless substance; very slightly soluble in cold water, more so in boiling water, and depositing from the latter by cooling. Its solution has the bitter acid taste of sarsaparilla, and froths on agitation. It is soluble in alcohol, ether, and oils. It does not combine with acids to form salts. Strong sulphuric acid colours it red, then violet, and, lastly, yellow. It dissolves in cold and pure hydrochloric acid: the solution becomes red and afterwards gelatinous when heated. It is soluble in strong nitric acid: if the solution be heated, nitrous gas escapes; and, by evaporation, a solid residuum is obtained, which is soluble in boiling water, from which it precipitates in white flocks as the liquid cools.

Smilacin is closely allied to, if it be not identical with, saponin. Now, as the latter is readily converted into an acid (*esculic acid*), so probably is the former: hence, perhaps, the parallinic acid of Batka may not be absolutely identical with smilacin, but bear the same relation to it that esculic acid does to saponin.

Smilacin has the following composition:—

	Poggiale. (Mean of 12 analyses.)	Henry.	Petersen.
Carbon	62.53	62.84	62.80
Hydrogen	8.67	9.76	9.14
Oxygen	28.80	27.40	28.06
Anhydrous smilacin	100.00	100.00	[Parillina] 100.00

Poggiale gives the following formula for its atomic constitution, $C^9H^{12}O^3$; while O. Henry⁴ assumes $C^9H^9O^3$, and Petersen⁵ $C^9H^8O^3$. As no definite compound of smilacin has been obtained, these formulæ are of little value. Thubent says that hydrated [crystallized] smilacin contains 8.56 water.

Callier⁶ gave it to nine syphilitic patients. In doses of six grains, the stomach readily supported it; but nine grains caused weight at the stomach and nausea. It appeared to relieve the patients' symptoms, and, in one case, seemed to effect a cure. According to Palotta, pariglin, in doses of from two to thirteen grains, acts as a debilitant, reducing the circulation, sometimes producing constriction of the œsophagus, and exciting nausea and diaphoresis. He thinks it might be useful in chronic rheumatism, skin diseases, &c.

3. STARCH.—This is found in both the cortical and medullary cells. It is most abundant in the Caraccas, Brazilian, and Honduras sarsaparillas, to which it gives their mealy character. According to Schleiden, it exists in two forms—as grains and as paste.

The starch-grains are arranged in groups of 2, 3, 4, or 6; their shapes being modified by their mutual compression: the prevailing form being that of a mullar. Their average length is about $\frac{1}{2000}$ th of an inch.⁷ The nucleus (central cavity or hilum) is scarcely perceptible by ordinary light (Schleiden says that the grains are without evident central cavity); but by the

¹ Journ. de Pharm. x. 543.

² Nouv. Traité de Pharm. ii. 166.

³ Thomson, Organic Chemistry, 279.

⁴ Journ. de Chim. Méd. x. 577.

⁵ Journ. de Pharm. xx. 682.

⁶ Journ. de Chim. Méd. t. i. p. 45, 2de sér.

⁷ The following measurements, in parts of an English inch, of the grains of starch of sarsaparilla, were made for me by Mr. George Jackson:—

aid of polarized light its position may be determined, as it is at the junction of the arms of the cross. In some grains it can be detected by common light. Towards the circumference of some of the grains a series of faint parallel curved lines are observed.

Starch paste, or amorphous starch, is found in some of the cortical cells. It is more abundant in Vera Cruz sarsaparilla, which is sun-dried, than in the Brazilian sort, which has been dried by exposure to the smoke of fires; hence, probably, its formation depends on the season, and not on the action of heat on the grain starch. Iodine colours it blue. This so-called starch-paste, or amorphous state, is, perhaps, only imperfectly formed and closely aggregated starch grains.

4. RESIN AND EXTRACTIVE.—These principles require further examination. On them probably depends a part, at least, of the medicinal properties of sarsaparilla.

CHEMICAL CHARACTERISTICS.—A decoction of sarsaparilla froths greatly when shaken. It scarcely, if at all, reddens litmus. Diacetate of lead and protonitrate of mercury cause precipitates. Alkalies deepen the colour of the decoction.

If a strong decoction be added to oil of vitriol, a red colour is produced (owing to the action of the acid on the smilacin?).

Decoctions of mealy sarsaparilla become dark blue (*iodide of starch*) on the addition of a solution of iodine. Decoctions of non-mealy sorts are usually somewhat darkened by iodine, but the effect frequently disappears after a few minutes.

If a solution of a persalt of iron be added to the decoction, more or less darkening is usually produced. The greatest effect is produced with decoctions of either Jamaica or Lima sarsaparilla: with those of the Honduras and Brazilian sorts the effect is much feebler. In some cases a flocculent precipitate slowly subsides.¹

If oil of vitriol be applied to a section of sarsaparilla, a greater or less portion of the woody surface (the woody zone, and, in the case of Jamaica and Lima sarsaparilla, the cortex also) becomes dark red, and then violet (owing to the action of the acid on the smilacin?). The same colour is also produced by the action of the acid on a fresh cut surface of the rhizome (*chump*).

If a strong decoction of mealy sarsaparilla be poured into alcohol, a copious precipitate (*starch*) is produced.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables*.—Not ascertained.

β. On Animals.—Not ascertained.

γ. On Man.—Imperfectly determined; no experiments having been made to ascertain its physiological effects.

To the taste, sarsaparilla is slightly acrid, and somewhat nauseous. Diaphoresis is by far the most common effect of its internal use. When the skin is kept cool, diuresis is not unusual. But in estimating the diaphoretic or diuretic power of sarsaparilla, we must take into consideration the amount of liquid in which the medicine is usually taken, and the other medicines which are frequently conjoined with it: for, in many instances, the diaphoresis or diuresis is referable rather to these than to sarsaparilla.

In several cases I have given the powder of this root in very large doses, in order to ascertain its effects. Nausea, vomiting, and temporary loss of appetite, were alone observed.

Dr. Hancock² says, that on one patient, an African, an infusion of four ounces of Rio Negro sarsa acted as a narcotic, producing nausea, great prostration of strength, torpor, and unwillingness to move. The pulse was scarcely altered, unless

Single round or hemispherical Particles.	Longest Diameters.
1	0.0006
2	*0.0005
3	*0.0004
4	0.0003
5	0.0002

The bulk of this specimen consisted of particles of the size of those distinguished by an asterisk.

One of the hemispherical or mullar-shaped particles measured 0.0007 by 0.0005.

A compound grain, consisting of three grains, was found to be 0.0005 in diameter.

¹ See, also, Marquart's comparative examinations of several kinds of sarsaparilla, in the *Pharmaceutical Journal*, vol. III. p. 126, 1843.

² *Trans. Med.-Bot. Soc.* 1829.

it were a little retarded. Though the effects here stated agree, to a certain extent, with those ascribed to smilacin, they cannot be regarded as the ordinary effects of this root.

In some conditions of system, especially those of a cachectic kind, sarsaparilla acts as a powerful and valuable alterative tonic. Its continued use is often attended with improvement of appetite and digestion, augmentation of strength, increase of flesh, the production of a more healthy tone of mind, and the palliation, or, in some cases, complete disappearance, of various morbid symptoms—as eruptions, ulcerations, pains of a rheumatic character, &c. Sarsaparilla differs in several respects from the bitter vegetable tonics. Though it is not devoid of, yet it does not, as they do, abound in a bitter principle. It is not adapted for the cure of intermittents, or of simple debility. But its best effects are seen in those depraved conditions of system, which the public, and even some medical men, ascribe to the presence of a morbid poison, or to a deranged condition of the fluids. Hence it is frequently denominated a *purifier of the blood*. Those who do not adopt the pathological notion here referred to, call it an *alterative*.

Those varieties of sarsaparilla which abound in starch (as the *Caraccas* and *Honduras* sorts) possess demulcent and nutritive properties.

USES.—By many practitioners sarsaparilla is considered to possess no remedial properties; by others it is regarded as a medicine of great efficacy. Considering that more than 100,000 lbs. of it are annually consumed in this country, the number of those who entertain the latter opinion cannot be small. It has been justly remarked by Mr. Lawrence,¹ that physicians have no confidence in it, and surgeons a great deal. I think that this fact is readily explained by the circumstance that physicians are much less frequently called in to prescribe for those forms of disease in the treatment of which surgeons have found sarsaparilla so efficacious.

Many practitioners have doubted or denied its remedial activity on what, it must be admitted, are very plausible grounds; viz., that the root possesses very little taste and no smell; that, by the ordinary mode of using it, it produces very slight, if any, obvious effects on the animal economy; and that it has failed in their hands to relieve or cure diseases in which others have asserted they found it effectual. They are, therefore, disposed to refer any improvement of a patient's health, under the long-continued use of sarsaparilla, either to natural changes in the constitution, or to the influence of the remedial means with which the sarsaparilla was conjoined. But I would observe, that hitherto no experiments have been made to ascertain what effects the long-continued employment of sarsaparilla may give rise to in the system of a healthy man; and we are not warranted in assuming that none would result, because none are observable from the employment of a few doses. Moreover, it is to be remembered that some of our most powerful poisons prove the most efficacious remedies when given in such small doses that they excite no other obvious effect on the system than the removal of morbid symptoms. Witness the beneficial influence of the minute doses of arsenious acid in lepra. Furthermore, no one has ascribed to sarsaparilla the power of a specific, and its warmest advocates admit its occasional failure. But so often has it been found, that various diseases, which had resisted all other tried remedial means, and were gradually increasing, became stationary, and afterwards subsided, under the use of sarsaparilla, that a large majority of British surgeons, including the most eminent of the present day, have been compelled to admit its therapeutic power.

As no obvious relationship exists between its known physiological effects and its apparent therapeutic agency, an argument has been raised against its medicinal activity, on the ground that we cannot explain its *modus medendi*; but, for the same reason, we might refuse to admit the power of cinchona to cure ague. Mr.

¹ *Lectures on Surgery*, in the *Lond. Med. Gaz.* vol. v. p. 770.

Lawrence¹ justly observes that, although we cannot point out the manner in which a remedy “operates, we not, on that account, to withhold our confidence in its power. It is enough for us, in medical science, to know that certain effects take place. In point of fact, we are in many cases unable to distinguish the *modus operandi* of medicines—the manner in which their influence is produced.” The most plausible explanation of the agency of alterative medicines is that offered by Müller,² and which I have before had occasion to notice (see vol. i. p. 137). It assumes that these remedies cause changes in the composition of the nutritive fluids (the chyle and blood), and thereby produce slight chemical alterations in organs morbidly changed in composition, by which already existing affinities are annulled, new ones induced, and the vital principle enabled to effect the further restoration and cure. This hypothesis may be used to explain the remedial influence of sarsaparilla.

Sarsaparilla has been found especially serviceable in the following maladies:—

1. *In inveterate venereal disease.*—It is beneficial principally when the malady is of long continuance, and the constitution is enfeebled and emaciated, either by the repeated attacks of the disease, or by the use of mercury. In such cases it is, as Sir William Fordyce³ correctly observed, “the great restorer of appetite, flesh, colour, strength, and vigour.” When the disease resists, or is aggravated by, the use of mercury, sarsaparilla evinces its most salutary powers. It is given to relieve venereal pains of a rheumatic character; to remove venereal eruptions; to promote the healing of ulcers of the throat; and to assist in the cure when the bones are affected. In recent chancre, or bubo, it is of little use; nor does it appear to possess the least power of preventing secondary symptoms. We cannot ascribe to it “the same anti-syphilitic properties—that is, the same power of arresting or curing the venereal disease—that experience warrants us in attributing to mercury.”⁴ Sarsaparilla is sometimes given alone, but more frequently with other remedies: as with stimulating diaphoretics (mezeoreon, sassafras, and guaiacum), or with mercurials in small or alterative doses, or with acids (especially the nitric), or with alkaline substances (as potash or lime), or with iodine or with the bitter tonics. It is difficult to lay down concise rules to guide us in the selection of these adjuncts. In venereal pains and eruptions, sudorifics, the copious use of warm diluents and warm clothing, are especially applicable, and should be conjoined with sarsaparilla. In serofulous constitutions, with enlarged glands, it will be for the most part advisable to avoid the use of mercury. In such I have seen the alkalies most serviceable. When extreme debility is present, the bitter tonics and nitric acid are often added to sarsaparilla with benefit. When the periosteum is affected, iodide of potassium should be conjoined.

2. *In chronic rheumatism* sarsaparilla is often advantageously conjoined with powerful sudorifics and anodynes (as opium or hyoseyamus), especially when any suspicion exists as to the venereal origin of the disease.

3. *In obstinate skin diseases* benefit is frequently obtained by the use of sarsaparilla. Its employment is not confined to cutaneous affections of one particular elementary form, since it is given with good effect in papular, vesicular, pustular, and tubercular skin diseases, of a chronic kind, when they occur in enfeebled and emaciated constitutions. Though, in these cases, its value principally depends on its tonic and alterative effects, its diaphoretic operation is to be encouraged by the use of diluents, warm clothing, &c.

4. *In cachectic conditions of the system generally*, sarsaparilla may be given, often with the best effects, and never with any ill consequences, save that of producing slight nausea. Indeed, one of the great advantages of sarsaparilla over many other alteratives and tonics, is, that although it may fail in doing good, it never does any

¹ *Op. cit.* p. 769.

² *Medical Observations and Inquiries*, vol. i. p. 169.

³ Lawrence, *op. cit.* p. 769; see, also, Mr. Pearson's *Observations on the Effects of various Articles of the Materia Medica in the Cure of Lues Venerea*, p. 39, 1800.

⁴ *Physiology*, vol. i. pp. 59 and 363.

harm beyond that of now and then causing slight disorder of stomach. In chronic abscesses, attended with profuse discharge, diseases of the bones, obstinate ulcers, chronic pulmonary affections accompanied with great wasting of the body, enlarged glands, and various other maladies connected with a depraved state of the system, sarsaparilla is often a very useful medicine.

ADMINISTRATION.—Sarsaparilla is administered in substance, and in the form of infusion, decoction, extract, and syrup.

1. **PULVIS SARSÆ**; *Powdered Sarsaparilla*.—The ordinary dose of this is from half a drachm to one or two drachms. Half an ounce frequently nauseates, and in some cases gives rise to vomiting. Powder of Jamaica sarsaparilla is to be preferred to that of other varieties. It is redder than that of the Honduras kind, and produces a much less intense blue colour when rubbed with water and tincture of iodine. I have been informed that some druggists employ, in the preparation of the powder, the roots from which the extract has been prepared. This fraud may be detected by the powder being almost devoid of taste, macerating it in water, and carefully comparing the infusion with one prepared from an unadulterated sample. The microscope might sometimes be carefully employed to detect adulterations of powdered sarsaparilla. The presence of foreign starch grains would indicate the presence of some other vegetable in the suspected powder.

[2. **INFUSUM SARSAPARILLÆ** [U. S.].—Take Sarsaparilla, bruised, an ounce; Boiling Water a pint. Digest it for two hours in a covered vessel or strain, or by displacement.]

3. **DECOCTUM SARSÆ**, L. E.; *Decoction Sarsaparillæ*, D.; *Decoction of Sarsaparilla*.—(Sarsa, sliced [in chips, E.], ℥v [℥ij, D.]; Boiling Water Oiv [Ojss, D.]. Boil down to two pints, and strain. ["The product should measure a little more than a pint," D.])—An objection has been taken to this, as well as to all preparations of sarsaparilla made by boiling, that the heat employed volatilizes or decomposes the active principle of the root. "An infusion of sarsaparilla," says Soubeiran,¹ "which is odorous and sapid, loses both its odour and taste by boiling for a few minutes: these changes speak but little in favour of the decoction. On the other hand, it is known that the fibrous parts of vegetables always give less soluble matters to water, when treated by decoction; and if it be added that sarsaparilla is completely exhausted by hot water, I cannot see what advantages the decoction can possess over preparations made by other methods." Without denying the injurious effects of long boiling, and, therefore, the superiority of preparations made without it, I cannot admit that either the decoction or extract of sarsaparilla is inert. No objection, however, exists to the substitution of an *infusion* for a decoction. But it is advisable to employ a somewhat larger quantity of the root, and to have it crushed before macerating it. The proportions of root and water, in the above preparation, are such that one ounce of the decoction contains the extractive of one drachm only of the root. Hence the extract or syrup is usually conjoined.

Mr. Jacob Bell² objects to taking out the roots after maceration, in order to bruise them, on the ground that by this process the wood may absorb a larger portion of the virtues of the bark in return for the inert starch which it gives out.

An infusion or decoction of Jamaica sarsaparilla usually produces little or no blue colour with tincture of iodine; whereas the corresponding preparations of Honduras sarsaparilla (the kind usually met with, cut in small split lengths, in the shops) becomes bluish black on the addition of a solution of iodine. The dose of *Decoction Sarsæ* is f℥iv to f℥viii three or four times daily.

4. **DECOCTUM SARSÆ COMPOSITUM**, L. E.; *Decoction Sarsaparillæ Compositum*, D. [U. S.]; *Compound Decoction of Sarsaparilla*.—(Decoction of Sarsaparilla, boiling hot, Oiv; Sassafras sliced and bruised, Guaiacum-wood shavings, Liquorice-root bruised, of each ℥x; Mezereon [bark of the root], ℥ij [℥ss, E.]. Boil for a

¹ *Nouv. Traité de Pharm.* t. ii. p. 168.

² *Pharmaceutical Journal*, vol. i. p. 55, 1841.

quarter of an hour and strain.—The *Dublin College* orders of Sarsaparilla Root, sliced, ℥ij; Sassafras Root in chips, Guaiacum wood turnings, Liquorice Root bruised, of each ℥ij; Mezereon root-bark ℥j; Boiling Water Oiss. Digest for one hour, then boil for ten minutes, cool and strain. The product should measure a little more than a pint.—[The *U. S. Pharm.* orders of Sarsaparilla, sliced and bruised, six ounces; Bark of Sassafras root sliced, Guaiacum wood rasped, Liquorice root bruised, each an ounce; Mezereon, sliced, three drachms; Water, four pints. Boil for a quarter of an hour, and strain.]—This preparation is an imitation of the celebrated *Lisbon Diet Drink*. The objections made to the use of ebullition in preparing the simple decoction apply equally to the present preparation. The additions are for the most part valueless. The guaiacum-wood is useless, water not being able to dissolve the resin. The volatile oil contained in the sassafras-wood is in part dissipated by the boiling. The mezereum, an active agent, is used in such small quantity that it can confer but little medicinal power. Moreover, these acids are apt to disorder the stomach. The liquorice is employed merely to communicate flavour. An improvement in the present formula would be to omit the guaiacum, to increase the quantity of sarsaparilla and mezereum, to substitute maceration for decoction, and to add oil of sassafras. The dose of the officinal preparation is from f℥iv to f℥vj three or four times a day. The syrup or extract is usually conjoined with it. During its use the skin should be kept warm.

A *Liquor Sarsæ compositus concentratus* is usually kept in the shops for the extemporaneous preparation of the compound decoction of Sarsaparilla.

5. SYRUPUS SARSÆ, L. E.; *Syrupus Sarsaparillæ*; *Syrup of Sarsaparilla*.—(Sarsa ℔ijss; Distilled Water Cong. ij; Sugar ℥xij; Rectified Spirit f℥ij. Boil the sarsa, in two gallons of the water, down to one gallon; pour off the liquor, and strain it while hot. Again boil the sarsa in the remaining water down to one-half. Evaporate the mixed liquors to two pints, and dissolve the sugar in them. Lastly, when cold, add the Spirit, L.—The *Edinburgh College* orders of Sarsa, in chips, ℥xv; Boiling Water Cong. j; Pure Sugar ℥xv.)—Simonin¹ has successfully prepared the syrup by the percolation method.

This I conceive to be a very unnecessary preparation; for, as the late Dr. A. T. Thomson² justly observes, “it can be much better and more easily supplied by rubbing up a few grains of the extract with some simple syrup.” It is, however, frequently prescribed as an adjunct to the decoction. Prepared with Jamaica sarsaparilla, it is not liable to ferment, and its flavour is somewhat agreeable, being very analogous to that of West India molasses. Mr. Brande³ says that, to be an effective form of sarsaparilla, it ought to be of such strength that one ounce is equal to a pint of the simple decoction. Of this, f℥ss or f℥vj may be taken two or three times a day, diluted with about two parts of water. A few drops of solution of potassa sometimes prevent its disagreement with the stomach.

The *Syrup of Sarsaparilla* of the United States Pharmacopœia is intended to represent the famous French *Sirup de Cuisinier*. It is prepared with proof spirit, which extracts the acrid principle of the root without taking up the inert fecula; and the tincture being evaporated, to get rid of the alcohol, is made into syrup. By this means the long-continued boiling is avoided. As the editors of the *United States Dispensatory* speak most confidently of the remedial value of this preparation, I subjoin the formula for its preparation, taken from the American Pharmacopœia:—

Compound Syrup of Sarsaparilla [*Syrupus Sarsaparillæ Compositus*], U. S.—“Sarsaparilla, bruised, ℔ij; Guaiacum wood, rasped, ℥ij; Red Roses, Senna, Liquorice-root, bruised, each ℥ij; Oil of Sassafras, Oil of Anise, each ℥v; Oil of Partridge-berry [*Gaultheria procumbens*, an astringent aromatic] ℥ij; Sugar ℔vij; Diluted Alcohol Ox [*wine measure*]. Macerate the sarsaparilla, guaiacum wood, roses, senna, and liquorice root, in the diluted alcohol for fourteen days; then express and filter through paper. Evaporate the tincture, by means of a water-bath, to four pints

¹ *Journ. de Pharm.* xx. 110.

² *London Dispensatory*, 9th edit.

³ *Dict. of Mat. Med.*

and a-half; then add the sugar, and dissolve it so as to form a syrup. With this, when cold, mix the oils, previously triturated, with a small quantity of syrup." The dose is f ʒss (equivalent to somewhat less than ʒj of the root), taken three or four times a day.

A *Syrupus Sarsæ compositus* is usually kept in the shops.

6. **EXTRACTUM SARSÆ LIQUIDUM**, L.; *Extractum Sarsæ fluidum*, E.; *Extractum Sarsaparillæ fluidum*, D. [U. S.]; *Fluid Extract of Sarsaparilla*, Offic.—(Sarsa ʒiijss; Distilled Water Cong. v; Rectified Spirit f ʒij, L.—Sarsa, in chips, ʒij; Boiling Water Ovj, E.—Sarsaparilla ʒij; Boiling Water Ovij; Rectified Spirit as much as is sufficient, D.—Boil the sarsa in three gallons of water down to twelve pints; pour off the liquor, and strain while hot. Again boil the sarsa in the remaining water to half, and strain. Evaporate the mixed liquors to f ʒxviiij, and when the extract has become cold add the spirit to it, L.—“Digest the root for two hours in four pints of the water; take it out, bruise it, replace it in the water, and boil for two hours; filter and squeeze out the liquid; boil the residuum in the remaining two pints of water, and filter and squeeze out this liquor also; evaporate the united liquors to the consistence of thin syrup; add, when the product is cool, as much rectified spirit as will make in all sixteen fluidounces; filter. This fluid extract may be aromatized at will with various volatile oils or warm aromatics,” E. The U. S. Pharm. orders of Sarsaparilla, sliced and bruised, sixteen ounces; Liquorice root bruised, Root of Sassafras bruised, each two ounces; Mezereon, sliced, six drachms; Sugar, twelve ounces; Diluted Alcohol, eight pints. Macerate all of the ingredients together, excepting the sugar, for fourteen days; then express and filter. Evaporate the liquid, by means of a water-bath, to twelve fluidounces; add the sugar to it while still hot; and remove it from the bath as soon as the sugar is dissolved.])

In this country, Jamaica sarsaparilla is preferred for the preparation of the extract; and next to this the Lima sort. If Honduras, or any other mealy sarsaparilla be employed, the product contains a large quantity of starch-gum. Extract of Jamaica sarsaparilla, when rubbed on white paper or porcelain, exhibits a reddish tint not observable in the extract of the Honduras kind. The flavour and odour are characters which assist in distinguishing well-prepared extract. Rubbed up with water, it is almost completely soluble, and the solution, which should be clear, by standing scarcely deposits anything. The dilute solution should not remain blue on the addition of a solution of iodine. But extract prepared from a mealy sarsaparilla does not completely dissolve in water, and yields a turbid liquor, which becomes dark blue on the addition of a solution of iodine.

In England the fibrils or *beard* of Jamaica sarsaparilla are preferred to both root and rhizome (*chump*). They contain less starch and woody fibre than the latter, and they yield a greater proportion of extract.

The quantity of extract obtained from Jamaica sarsaparilla has already been alluded to (see *ante*, p. 270). The following table is from the papers of Thuëuf:—¹

6 lbs. of Sarsaparilla	yielded of Extract.
Roots cleaned and deprived of rhizome	Red Jamaica sarsaparilla 3xxj, ʒij.
	Red sarsaparilla of the Coast [Costa Rica?] 3xxj, ʒij.
	Vera Cruz sarsaparilla 3xviij, 3viij.
	Caraccas sarsaparilla 3xv, 3iiij.
	Honduras sarsaparilla 3xiv,
Rhizome cut thin and bruised	Lisbon 3xiiij, ʒiiss.
	3ix, 3iiijss.

Extract made by the evaporation of an infusion prepared by the displacement process is devoid of starch, and is consequently richer in the active principles. By the avoidance of ebullition, the destruction or dissipation of volatile matters is less likely to be effected.

¹ *Journ. de Pharmacie*, t. xiv. p. 701; and t. xviii. p. 157.

In effecting the evaporation of the decoction or infusion, steam heat should be employed; and the temperature of the liquid should not be allowed to exceed 212° F.

When the concentrated decoction (especially of the Honduras kind) is allowed to cool, as at night, a kind of fermentation is readily set, and gas is copiously evolved.

Extract of sarsaparilla, when it has been kept for some time, frequently becomes covered by cubical crystals of chloride of potassium.

It deserves notice that though smilacin is said to be soluble in boiling alcohol and ether, yet I find that the extract of Jamaica sarsaparilla yields but little to these liquids.

Extract of sarsaparilla is declared by many writers to be an inert and useless preparation; but the assertions are, for the most part, founded rather on theoretical than practical considerations. I have extensively used it, and believe that, when properly prepared from Jamaica or Lima sarsaparilla, it is a most valuable and efficient remedy; and the enormous quantity of it which is consumed by the profession generally (including some of the most eminent of its members), is a proof that many others entertain a similar opinion of it. It is given in doses of from half a drachm to two or three drachms three or four times a day. It should be rubbed down with water, and flavoured by the tincture of orange-peel, or by some volatile oil (as the oil of cloves, allspice, lemon, or cinnamon). Alkalies render its flavour somewhat disagreeable, though they frequently increase greatly its remedial powers.

7. EXTRACTUM SARSÆ COMPOSITUM; Compound Extract of Sarsaparilla.—Not in any Pharmacopœia, though kept in the shops. It is made by mixing, with extract of sarsaparilla, an extract prepared by evaporating a decoction of mezereon bark, liquorice root, and guaiacum shavings, to which a small quantity of oil of sassafras has been added. This preparation is employed as a convenient substitute for the compound decoction of sarsaparilla. The dose of it, and the mode of exhibition, are the same as of the simple extract. Three-quarters of an ounce of the compound extract are equal to a pint of the compound decoction.

98. Smilax China, Linn.

(Radix.)

SMILAX CHINA. Kaempf. Amoen. Exot., p. 783; Loureiro, Fl. Cochinchinensis, p. 622.—A native of Japan, China, and Cochin China.—The *China* root of the shops (*radix Chinae orientalis* seu *vera* vel *ponderosa*) is said to be the produce of this species. But, according to Roxburgh,¹ the roots of *S. glabra* and *S. lanceafolia*, which are used in the East in medicine, are not to be distinguished by the eye from the roots of *S. China*, brought from China.

China root is imported into England, usually in baskets, from Calcutta and Singapore. Dr. O'Shaughnessy² states that it is largely imported into Calcutta from the eastward. It is said to be the produce of the province of Onansi, in China. It occurs in large, ligneous, knotty pieces, of from three to eight inches long, and an inch or two thick. Externally it has a grayish-brown colour, and internally a light flesh or yellowish-white colour. It is inodorous, and has a slightly astringent taste.

It has been analyzed by Reinsch,³ who found it to consist of wax 0.3, balsamic resin 0.4, crystalline matter (smilacin) 2.8, with sugar, tannic acid, salts, and resinous colouring matter (quantity not stated), tannic acid with salts, reddish gummy colouring matter, and smilacin 4.8, starch-gum, vegetable gluten, and salts 2.6, starch 23.5 with salts, starch with tannic acid 34.0, woody fibre 20.0, and water 12.0 (=100.4).

It was introduced into Europe, in 1535, as an infallible remedy for the venereal disease, and obtained great celebrity in consequence of the benefit which the Emperor Charles the Fifth is said to have derived from it in gout. Its effects are not very obvious, but it is said to be diaphoretic. It tinges the sweat. It has been used in the same maladies as sarsaparilla, viz., venereal diseases, rheumatism, gout, obstinate skin diseases, &c. It is given in the form of decoction.

¹ Fl. Indica, vol. iii. p. 792.

² Buchner's Repertorium, 2ter Reihe, Bd. xxxii. S. 145, 1843.

³ Bengal Dispensatory.

SPURIOUS CHINA ROOTS.—Several smilaceous roots, the produce of the New World, but resembling the oriental China root, have been described under the name of *American* or *occidental China root* (*radix Chinæ Americane* vel *occidentalis*). Their origin is by no means well ascertained, though they are usually said to be the produce of *Smilax Pseudo China*, Linn. Hernandez¹ notices three sorts: one which he calls *Olcacatzan* or Mexican China root; a second termed *Phaco*; and a third called *Cozolmecatl*.

One or more sorts of *occidental China root* are frequently found in the middle of the bundles of Lima and some other kinds of sarsaparilla (see *ante*, p. 271).

Brazilian China root, known by the various names of *Juapecanga*, *Inhapecanga*, *Japicanga*, *Jupicanga*, and *Raiz de China branca vel rubra*, is obtained from several species of *Smilax*: viz., *S. Japicanga*, Grisebach; *S. syringoides*, Grisebach (*Jupiranga*, Piso, Med. Braz. i. 99); *S. Brasiliensis*, Grisebach (*S. glauca*, Martius, Reise, i. 283); and *S. syphilitica*, Humboldt. It has not been analyzed. Its uses resemble those of oriental China root.²

99. *Smilax aspera*, Linn.

(Radix.)

Σμίλαξ τραχεῖα, Dioscorides, lib. iv. cap. 144. *Smilax*, Pliny, lib. xvi. cap. 63.—A native of the South of Europe. Its roots constitute *Italian sarsaparilla* (*Sarsaparilla italica*). They have not been analyzed. Their effects, uses, and mode of administration resemble those of the ordinary sarsaparilla brought from America.³

The roots of *Hemidesmus indicus*, or Indian sarsaparilla, are frequently sold in London under the name of *Smilax aspera*. They will be noticed hereafter.

Class IV. *Exogenæ*, DC.—*Exogens*.

DICOTYLEDONES, Jussieu.

CHARACTERS.—*Trunk*, consisting of bark, wood, and pith, placed one within the other, the pith being innermost. *Bark*, composed of strata (the younger and inner being called *endophleum* or *liber*), each usually increasing by the deposit of new matter on its inner side. *Wood*, consisting of ligneous strata, traversed by *medullary rays*, and increasing by the deposit of new woody matter on its outer side (*exogenous growth*); the older and inner strata are called *duramen*, or *heart wood*; the younger and outer strata are termed *alburnum*, or *sap wood*. *Leaves* usually articulated with the stems; their veins commonly branching and anastomosing (*netted, reticulated*). *Flowers*, if with a distinct calyx, often having a quinary, sometimes a quaternary, rarely a ternary arrangement. *Embryo* with two or more cotyledons (*dicotyledonous*); if two, they are opposite; if more than two (*polycotyledonous*), they are verticillate, radicle naked, i. e. elongating, without penetrating any external case (*exorrhizous*).

This class includes two sub-classes: 1. *Gymnospermæ*, or naked-seeded exogens; 2. *Angiospermæ*, or covered-seeded exogens.

Sub-class I. *Gymnospermæ*.—*Gymnosperms*.

GYMNOGENS, Lindl.

CHARACTERS.—*Ovules* naked, in an open carpellary leaf or pervious disk, fertilized by direct application of the pollen to the foramen (*micropyle*) without the intervention of stigma, style, and ovary. *Ligneous tissue* porous at the sides, the pores being apparently surrounded each by one or two circles.

This sub-class includes two orders: 1. *Cycadeæ*, or Cycads; 2. *Pinaceæ*, or Conifers.

¹ *Rerum Med. Nov. Hispan. Thesaurus*, pp. 212-213, Romæ, 1651.

² For a figure and description of Brazilian China root, see Goebel and Kunze's *Pharmaceutische Waarenkunde*, Bd. ii. S. 129, Taf. xviii. Fig. 2.

³ For further details respecting the medicinal properties of *Smilax aspera*, see Mérat and De Lens, *Dict. Univ. de Mat. Méd.* t. vi. p. 374, 1834; and Dierbach's *Neuest. Entdeck. in d. Mat. Méd.* Bd. iii. Abt. ii. S. 1088. 1847.

ORDER XXI. CYCADACEÆ, *Lindl.*—CYCADS.CYCADEÆ, *Richard and R. Brown.*

CHARACTERS.—Gymnosperms with a simple continuous *stem*, parallel-veined *pinnate leaves*, and *scales* of the cone antheriferous.

PROPERTIES.—Mucilage and starch are the useful products of this order. They are found in the stems and seeds (see *Cycas* and *Zamia*). The seeds of *Dion edule* yield a starch which is used in Mexico as arrow-root. (*Lindley*.)

100. *Cycas*, *Linn.**Sex. Syst.* Diœcia, Polyandria.

No product of this genus is employed in Europe, either as medicine or food. From the stems of *C. circinalis* and *C. revoluta* a starch is obtained, of which a kind of *sago* is said to be made in the East. I have prepared starch from both of these species, and find that its microscopic characters are entirely different from those of the sago starch of European commerce. The starch of *C. circinalis* consists of grains united in masses of from 2 to 6: the single grains are rendered more or less irregular or polygonal by their mutual compression, but hemispherical and muller-shaped particles predominate. Their size¹ varies, but is on the average smaller than that of the starch grains of genuine sago. The so-called hilum frequently appears split and surrounded by rings. In polarized light the grains show a distinct cross.—The starch of *C. revoluta*, of which *Japan sago* is said to be made, resembles that of the preceding species. None of it comes to England. The Dublin Pharmacopœia, 1850, states that sago is the farina of the interior of the trunk of *Cycas circinalis*, and also of other species of *Cycas*, and various *Palmaceæ*. The facts, however, are as I have stated them.—A clear mucilage, which concretes into a gum like tragacanth, exudes from fresh-wounded parts of several species of *Cycas*.²

101. *Zamia*, *Linn.**Sex. Syst.* Diœcia, Polyandria.

In the Bahamas, and some other of the West India Islands, a starch is obtained from the trunk of some species of this genus, which is employed as an excellent sort of arrow-root. None of it, to my knowledge, comes to Europe as an article of commerce. In the Museum of Economic Botany, at the Botanic Garden, Kew, there is a specimen of a starch, sent from Jamaica by Mr. Purdie, and stated to be "A nutritious powder made from the trunk of *Zamia integrifolia*, and sold in the West India Markets." In external appearance it resembles West Indian Arrow-root (*Maranta arundinacea*): but when examined by the microscope it is found to consist of rather large-sized grains,³ some of which are spheroidal; but most of them are the

¹ The following measurements, in parts of an English inch, of the starch of *C. circinalis*, were made for me by Mr. George Jackson:—

Single Grains.		Compound Grains.	
	0.0015		0.0015 by 0.0008
	0.0013		0.0013 by 0.0010
	0.0010		
Round	0.0008 by 0.0007		
	0.0005		
	0.0004		
	0.0003		
Hemispherical {	0.0011 by 0.0009		
	0.0007 by 0.0006		

These particles of which one diameter only is given had a circular outline, and were probably muller-shaped grains seen endwise.

² Roxburgh, *Fl. Indica*, vol. iii. p. 749.

³ The following measurements of 12 grains were made for me by Mr. George Jackson:—

MEASUREMENTS OF STARCH FROM ZAMIA INTEGRIFOLIA.	
Parts of an English Inch.	Parts of an English Inch.
1. 0.0022 \ 0.0021	7. 0.0011 × 0.0009
2. 0.0022 × 0.0018	8. 0.0013 × 0.0010
3. 0.0020 × 0.0019	9. 0.0009 × 0.0007
4. 0.0018 × 0.0016	10. 0.0007 × 0.0006
5. 0.0017 × 0.0014	11. 0.0004 × 0.0004
6. 0.0014 × 0.0013	12. 0.0003 × 0.0003

separated parts of compound grains, and, therefore, are variously shaped, owing to their mutual compression; some being hemispheres, others muller-shaped grains, &c. The nucleus and rings are scarcely discernible. Most of the grains present a superficial protuberant scar (like the hilum of some seeds), the situation of which is remote from the nucleus (as ascertained by polarized light).

[*Zamia Media*.—This is an intermediate species between *Z. integrifolia* and *Z. angustifolia*. It differs from the former in having more numerous, longer, and narrower leaflets, which are perfectly entire, or nearly destitute of the serratures at the apex. The footstalk is hairy at base, and the female cone is obtuse, not pointed. Specimens have been brought to me from Florida by Dr. Godon, of the U. S. Navy, which agree with those, from the same locality, in the Herbarium of the Academy of Natural Sciences.

The root of this plant is a large spheroidal or somewhat tapering coated tuber, rough and dark-coloured externally, fleshy, internally white and succulent, and, when incised, pouring forth a fluid of gummy consistence, which hardens in small tears at the point of exit. This root is called *coonti* root in Florida by the Indians and white settlers, and the farina prepared from it is also called *coonti*. As a nutriment, it is found in the shops of the northern cities of the United States, under the name of *Florida arrow root*. When carefully prepared, it has a mealy appearance and feel, is of a pure white colour, and somewhat of a lustrous appearance; it is apt to be lumpy. The mode of preparation is the same as that of Bermuda arrow root. The form of the granule is that of the "half, fourth, or third of a solid sphere." Some of the granules are completely muller-shaped, in fact the form is exactly that given by Raspail for the granule of the *Maranta Arundinacea*, which is invariably round.

Florida arrow-root is employed for the same purposes and in the same manner as the other species of farina in use.—J. C.]

ORDER XXII. PINACEÆ, *Lindley*.—CONIFERS.

CHARACTERS.—*Flowers* monœcious or diœcious, naked. *Males* monandrous or monadelphous; each floret consisting of a single *stamen*, or of a few united, collected in a deciduous amentum; about a common rachis; *anthers* 2-lobed or many-lobed, bursting longitudinally; often terminated by a crest, which is an unconverted portion of the scale out of which each stamen is formed. *Females* in cones. *Ovary* spread open, and having the appearance of a flat scale destitute of style or stigma, and arising from the axil of a membranous bract. *Ovule* naked; in pairs or several, on the face of the ovary, inverted, and consisting of one or two membranes, open at the apex, together with a nucleus. *Fruit* consisting of a cone formed of the scale-shaped ovaries, become enlarged and indurated, and occasionally of the bracts also, which are sometimes obliterated, and sometimes extend beyond the scales in the form of a lobed appendage. *Seed* with a hard crustaceous integument. *Embryo* in the midst of fleshy, oily albumen, with 2 or many opposite *cotyledons*; the *radicle* next the apex of the seed, and having an organic connection with the albumen.—*Trees* or *shrubs*, with a branched trunk abounding in resin. *Wood* with a ligneous tissue marked with circular disks. *Leaves* linear, acerose or lanceolate, entire at the margins; sometimes fascicled in consequence of the non-development of the branch to which they belong; when fascicled, the primordial leaf to which they are then axillary is membranous, and enwraps them like a sheath. (*Lindley*.)

PROPERTIES.—Every part of coniferous plants contains an oleo-resinous juice, which, by distillation, is resolved into volatile oil and resin. The medicinal properties of this juice have been before noticed (see vol. i. pp. 254–256).

Sub-order I. ABIETEÆ.

Ovules inverted; pollen oval, curved.

102. PINUS, *DC.*—THE PINE.

Sex. Syst. Monœcia, Monadelphia.
(Oleo-resinæ.)

BOTANY. Gen. Char.—*Flowers* monœcious. **MALES:**—*catkins* racemose, compact and terminal; squamose; the *scales* stamiferous at the apex. *Stamens* 2; the *anthers* 1-celled. **FEMALES:** *catkins* or *cones* simple, imbricated with acuminate scales. *Ovaries* 2. *Stigmas* glandular. Scales of the *cone* oblong, club-shaped, woody; umbilicato-angular at the apex. *Seeds* [nuts, *DC.*] in pairs, covered with

a sharp-pointed membrane. *Cotyledons* digitato-partite. *Leaves* 2 or many, in the same sheath (DC. and Dubuy, *Bot. Gall.*).—Hardy, evergreen trees.

Species.—1. *PINUS SYLVESTRIS*, Linn.; *Wild Pine* or *Scotch Fir*.—*Leaves* in pairs, rigid. *Cones* ovato-conical, acute; young ones stalked, recurved, as long as the leaves; generally in pairs. Crest of the *anthers* very small. *Embryo* 5-lobed (*Bot. Gall.*).—Highlands of Scotland, Denmark, Norway, and other northern countries of Europe. Flowers in May and June. A tall, straight, hardy, long-lived tree, determinately-branched. Its *wood* is the red or yellow deal. It yields *common turpentine*, *tar*, and *pitch*.

2. *PINUS PINASTER*, Aiton, Lambert; *P. maritima*, DC.; *the Pinaster* or *Cluster Pine*.—*Leaves* twin, very long, rigid, pungent, furnished at the base with a reflexed scale. *Cones* oblong-conical, obtuse, very smooth, bright, shorter than the leaves. *Scales* bristly (*Bot. Gall.*).—Southern maritime parts of Europe. Very abundant in the neighbourhood of Bordeaux, and between this city and Bayonne. It is a much larger tree than the Scotch Fir. Flowers in May. It yields *Bordeaux turpentine*, *galipot*, *tar*, and *pitch*.

3. *PINUS PALUSTRIS*, Lambert; *the Swamp Pine*. *Leaves* 3, very long. *Cones* subcylindrical, armed with sharp prickles. *Stipules* pinnatifid, ragged, persistent (Lambert).—A very large tree, growing in dry sandy soils, from the southern parts of Virginia to the Gulf of Mexico. "Its mean elevation is 60 or 70 feet, and the diameter of its trunk about 15 or 18 inches for two-thirds of this height. The *leaves* are about a foot in length, of a brilliant green colour, and united in bunches at the ends of the branches. The names by which the tree is known in the Southern States are *long-leaved pine*, *yellow pine*, and *pitch pine*; but the first is the most appropriate, as the last two are applied also to other species. This tree furnishes by far the greater proportion of *turpentine*, *tar*, &c., consumed in the United States, or sent from this to other countries."¹

4. *PINUS TÆDA*, Lambert; *the Frankincense Pine*.—Abundant in Virginia. Yields *common turpentine*, but of a less fluid quality than that which flows from the preceding species.

5. *PINUS PINEA*, Lambert, DC.; *the Stone Pine*.—Grows in the south of Europe and northern part of Africa. Yields the cones called, in the shops, *pignoli pines*, the seeds of which, termed *pine nuts* (πινυίδες, Diosc.; *pityida*, Pliny; *nuclei pineæ pineoli*) are used as a dessert.

6. *PINUS PUMILIO*, Lambert; *the Mugho* or *Mountain Pine*.—A native of the mountains of the south of Europe. An oleo-resin, called *Hungarian balsam* (*Balsamum Hungaricum*), exudes spontaneously from the extremities of the branches, and from other parts of the tree. By distillation of the young branches with water, there is obtained in Hungary an essential oil, called *Krummholzöl*, or *oleum templinum*.

7. *PINUS CEMBRA*, Lambert, DC.; *the Siberian Stone Pine*.—The seeds, like those of *Pinus Pinea*, are eaten. By distillation the young shoots yield *Carpathian balsam* (*balsamum carpathicum*; *b. Libani*).

103. ABIES, DC.—THE FIR.

Sex. Syst. Monœcia, Monadelphia.
(Oleo-resinæ.)

BOTANY. *Gen. Char.*—*Flowers* monœcious. **MALES:** *catkins* solitary, not racemose; the *scales* stamiferous at the apex. *Stamens* two; the *anthers* 1-celled. **FEMALES:** *catkins* simple. *Ovaries* 2. *Stigmas* glandular. *Scales* of the cone imbricated; thin at the apex, rounded (neither thickened, angular, nor umbilicated on the back). *Cotyledons* digitato-partite. *Leaves* solitary in each sheath (*Bot. Gall.*).

¹ United States Dispensatory.

Species.—1. *ABIES EXCELSA*, DC.; *A. communis*, Hort.; *Pinus Abies*, Linn.; *the Norway Spruce Fir*.—*Leaves* tetragonal. *Cones* cylindrical; the scales rhomboid, flattened, jagged, and bent backwards at the margin (*Bot. Gall.*)—A native of Germany, Russia, Norway, and other parts of Europe; also of the northern parts of Asia. Commonly cultivated in England. Flowers in May and June. A very lofty tree, growing sometimes to the height of 150 feet. It yields by spontaneous exudation *common frankincense* (*abietis resina*; thus, L. D.), from which is prepared *Burgundy pitch*, D. (*pix burgundica*, L. E., *pix abietina*).

The leaf-buds (*gemmæ seu turiones abietis*) of this species of *Abies*, as well as of the Silver Fir (*Abies Picea*), are used on the continent, in the form of decoction or beer; or, with the woods of guaiacum and sassafras, and juniper berries, in the form of tincture (*tinctura pini composita*, Ph. Bor.). They are employed in scorbutic, rheumatic, and gouty complaints.

2. *ABIES BALSAMEA*, Lindley; *Pinus balsamea*, Linn., Lambert; *the Canadian balsam Fir*; *Balm of Gilead Fir*.—*Leaves* solitary, flat, emarginate, subpectinate, suberect above. Scales of the flowering cone acuminate, reflexed.—An elegant tree, seldom rising more than 40 feet. Inhabits Canada, Nova Scotia, Maine, Virginia, and Carolina. Yields *Canadian balsam* (*Terebinthina canadensis*, L.; *Balsamum canadense*, E. D.).

3. *ABIES CANADENSIS*, Lindley;¹ *Pinus canadensis*, Linn., Lambert; *the Hemlock Spruce Fir*.—Said to yield an oleo-resin analogous to Canada balsam.

4. *ABIES PICEA*, Lindley; *Abies pectinata*, DC.; *Pinus Picea*, Linnæus; *the Silver Fir*.—Mountains of Siberia, Germany, and Switzerland. Yields *Strasburgh turpentine*.

5. *ABIES NIGRA*, Michaux; *Pinus nigra*, Lambert; *the Black Spruce Fir*.—The concentrated aqueous decoction of the young branches is *essence of spruce*, used in the preparation of *spruce beer*.²

Essence of spruce (*essentia abietis*) is prepared by boiling the young tops of some coniferous plant (in America, those of *Abies nigra*, or *black spruce*, are used) in water, and concentrating the decoction by evaporation. "It is a thick liquid, having the colour and consistence of molasses, with a bitterish, acidulous, astringent taste."³ It is used in the preparation of spruce beer.

Spruce beer (*cerevisia abietis*) is thus prepared: "Take of *Essence of Spruce half a pint*; Pimento (bruised), Ginger (bruised), Hops, of each *four ounces*; Water *three gallons*. Boil for five or ten minutes; then strain, and add, of Warm Water *eleven gallons*; Yeast *a pint*; Molasses *six pints*. Mix, and allow the mixture to ferment for twenty hours."⁴ It is sometimes taken as an agreeable and wholesome drink in summer. It is diuretic and anti scorbutic, and is, in consequence, employed in long sea-voyages as a preventive of scurvy.

104. LARIX EUROPÆA, DC.—THE COMMON LARCH.

Sex. Syst. Monœcia, Monadelphia.

(*Terebinthina Veneta*, L. D.)

BOTANY. Gen. Char.—*Flowers* monœcious. *Character* as in *Abies*; but the *cotyledons* are simple, and never lobed. *Cones* lateral. *Leaves*, when first expanding, in tufted fascicles, becoming somewhat solitary by the elongation of the new branch (*Bot. Gall.*).

Sp. Char.—*Leaves* fascicled, deciduous. *Cones* ovate-oblong. Edges of *scales* reflexed, lacerated. *Bracts* panduriform (Lambert).

Hab.—Alps of Italy, Switzerland, Germany, Siberia, &c. Cultivated in woods.

PRODUCTS.—This species yields *larch* or *Venice turpentine*. When the larch forests of Russia take fire, a gum issues forth from the medullary part of the trunks, during combustion, which is called *Orenburgh gum* (*gummi orenburgense*). A saccharine matter exudes from the larch, about June, which is called *manna of the larch*, or *manna de Briançon*. Lastly, a fungus, called *Polyporus officinalis* (see *ante*, p. 92), is nourished on this tree.

¹ London's *Encyclopædia of Plants*.

² *Ibid.*

³ *United States Dispensatory*.

⁴ *Ibid.*

MEDICINAL SUBSTANCES OBTAINED FROM THE PRECEDING CONIFEROUS PLANTS.

The term *turpentine* (*terebinthina*) is ordinarily applied to a liquid or soft solid oleo-resinous juice of certain coniferous plants, as well as of the *Pistachia Terebinthus*, a plant of the order *Terebinthaceæ*, Juss. Indeed, this last-mentioned plant, *Pistachia Terebinthus*, is probably the true *Terebinthus* of the ancients (Τερμινθος, Theoph. and Dioscorides). When submitted to distillation, these juices are resolved into *volatile oil* and *resin*. The roots, and other hard parts of coniferous trees, yield, by a kind of *distillatio per descensum*, the thick liquid called *tar*, from which *pitch* is procured. Hence it will be convenient to speak of the coniferous terebinthines under four heads: 1st, the *oleo-resinous juices*; 2dly, the *volatile oil* obtained therefrom by distillation; 3dly, the *resinous residuum*; 4thly, *tar* and *pitch*.

1. Oleo-Resinæ Terebinthinæ.—Terebinthinate Oleo-Resins.

At first these oleo-resins are liquid, but by age and exposure to the air they become, more or less speedily in the different varieties, solid, partly by the volatilization, and partly by the resinification of the volatile oil. They have a certain general similarity in taste and odour. They soften and become very fluid by heat, readily take fire in the air, and burn with a white flame, and, if the supply of air be limited, with the copious deposition of finely-divided carbon (*lamp black*). They are almost completely soluble in alcohol and ether; and yield, by distillation, a volatile oil and a resinous residuum. It must not be inferred that the identical volatile oil and resin into which these oleo-resins are resolved by distillation pre-exist in the juices which yield them; for in some cases it is certain they do not, but are products, not educts, as I have elsewhere¹ shown. Thus balsam of Canada possesses the property of *right-handed* circular polarization; and, by distillation, yields a volatile oil and a residual resin, both of which enjoy the power of *left-handed* circular polarization. It is obvious, therefore, that during distillation some molecular change must have been effected in the proximate principles of the balsam. American turpentine, on the other hand, possesses the power of *left-handed* circular polarization; but, by distillation, yields a volatile oil (oil of turpentine of English commerce) which produces *right-handed* polarization.

Water acquires a terebinthinate flavour when digested with them; and by the aid of the yolk or the white of an egg, or, still better, by that of vegetable mucilage, forms an emulsion with them.

1. COMMON TURPENTINE (*Terebinthina vulgaris*).—Under this name we find oleo-resins brought from various parts of the world, obtained from different species of *Pinus*, and, though agreeing in the main in their properties, possessing certain distinctive characters. At the present time, the London market is almost exclusively supplied from the United States of America, a small quantity only being occasionally imported from Bordeaux.

a. *American or White Turpentine, Terebinthina Americana*, L. (the *Térébenthine de Boston* of the French) "is procured chiefly from the *Pinus palustris*, partly, also, from the *Pinus Træda*, and perhaps some other species inhabiting the Southern States. In former times, large quantities were collected in New England; but the turpentine trees of that section of the Union are said to be nearly exhausted; and our commerce is almost exclusively supplied from North Carolina and the south-eastern parts of Virginia."²

The method of procuring this turpentine is as follows: A hollow is cut in the tree, a few inches from the ground, and the bark removed for the space of about

¹ *Pharmaceutical Journal*, vol. v. p. 67, 1815.

² *United States Dispensatory*.

18 inches above it. The turpentine runs into these excavations from about March to October; more rapidly, of course, during the warmer months. It is transferred from these hollows into casks¹

It is imported from New York in casks; those from North Carolina holding 2 cwt., while those from South Carolina contain $2\frac{1}{2}$ cwt. It is yellowish-white, with an aromatic odour, and a warm, pungent, bitterish taste. It is translucent or opaque. Its consistence varies, being semifluid, or, in cold weather, that of a soft solid. It contains various impurities (leaves, twigs, chips, &c.). That got from the firstappings is the best, and is called *virgin turpentine*. Recent American turpentine is said² to yield 17 per cent. of essential oil.

This sort of turpentine possesses the property of left-handed circular polarization; but it yields by distillation a volatile oil having right-handed polarization.

American turpentine is melted and strained, and in this state it is sometimes called *refined turpentine*.

Old and concrete American turpentine is sometimes sold for *frankincense* (thus *vel abietis resina*).

β. *Bordeaux Turpentine* is obtained by making incisions in the *Pinus Pinaster*, Lambert (*P. maritima*, DC.), and collecting the turpentine in hollows at the foot of the tree. Every month these hollows are emptied, and the oleo-resin conveyed in pails to a reservoir. In this state it is called *soft gum* (*gomme molle*). It is purified either by heating it in large boilers, and filtering through straw (*térébenthine galipot*), or by exposing it in a barrel, the bottom of which is perforated by holes, to the sun; the liquid which drains through is called *térébenthine au soleil*. The last method yields the best product, since less volatile oil is dissipated by it.³ The turpentine which flows during the winter is called *galipot* in Provence, *barras* in Guienne. It is in the form of semi-opaque, solid, dry crusts of a yellowish-white colour, a terebinthinate odour, and a bitter taste.⁴

Bordeaux turpentine is whitish, thickish, and turbid. It has a disagreeable odour, and an acrid, bitter, nauseous taste. On standing, it separates into two parts: one thinner, yellow, and almost transparent; another thicker, whitish, and of the consistence of thick honey, having a granular consistence. Bordeaux turpentine readily becomes hard and dry by exposure to the air. It possesses the property of left-handed circular polarization; and yields by distillation an oil which also has left-handed polarization. It enjoys, with balsam of copaiva, the property of solidifying with magnesia, and in this respect is distinguished from Strasburgh turpentine.

Common turpentine has been analyzed by MM. Moringlane, Duponchel, and Bonastre,⁵ and by Unverdorben.⁶ The last-mentioned chemist found it to consist of *two volatile oils* (*oil of turpentine*), *pinic acid*, a little *sylic acid*, a trace of an *indifferent resin* not soluble in oil of petroleum, and a small quantity of *bitter extractive*. The quantity of volatile oil varies from 5 to 25 per cent. of the weight of the turpentine. Laurent has discovered in Bordeaux turpentine a resinous acid, *pimaric acid*, isomeric with pinic acid.

2. *LARCH OR VENICE TURPENTINE* (*Terebinthina veneta*; *Terebinthina laricina*). Obtained from *Larix Europæa*, DC., by boring the trunks of the trees, and adapting to each hole a wooden gutter, which conveys the juice into a tub or trough, from which it is afterwards withdrawn for filtration.⁷

Through the kindness of Professor Guibourt I have received an authentic sample of larch turpentine. It was collected in the wood of the Bishop of Maurienne, in Savoy, by order of the bishop, and at the urgent solicitation of M. Bonjean, pharmacien, naturalist of Chambéry. The same kind of turpentine, collected in Swit-

¹ Michaux, *N. Am. Sylv.* iii.; Way, *Trans. of the Society of Arts*, vol. xxviii. p. 89; Duhamel, *Traité des Arbres*, t. ii. p. 146, Paris. 1755.

² *United States Dispensatory*.

³ Guibourt, *Hist. des Drog.* t. ii. p. 578; Duhamel, *Traité des Arbres*, t. ii. p. 147.

⁴ Guibourt, *op. cit.*

⁵ Berzelius, *Traité de Chim.*; and Gmelin, *Handb. de Chem.*

⁷ Duhamel, *Traité des Arbres*, t. i. p. 335.

⁶ *Journ. de Pharm.* t. viii. p. 329.

zerland (*Swiss turpentine*)¹ is sold in Paris as *Strasburg turpentine* (*Térébenthé de Strasbourg*),² and was formerly called *Venice turpentine*. It is a thick and consistent fluid, flowing with difficulty, is sometimes transparent, but more frequently cloudy, has a yellow or greenish-yellow tint, an odour which is peculiar, not very agreeable, weaker than that of either Strasburg or common turpentine, but less disagreeable than the latter, and an acrid, very bitter taste. It has little or no tendency to concrete by keeping—a property known to Pliny,³ and which distinguishes it from common turpentine.

A factitious substance (*terebinthina veneta factitia*) is sold by London druggists for Venice turpentine. It is prepared by melting together oil of turpentine and black rosin. A similar preparation is found in the shops of the United States of America,⁴ and is probably identical with that imported from America under the name of Venice turpentine.⁵

Berzelius and Unverdorben⁶ have submitted Venice turpentine to examination, and with the following results:—

Berzelius's Analysis.

1. Oil of turpentine, probably composed of two oils.
2. Resin insoluble in cold oil of petroleum.
3. Resin soluble in cold oil of petroleum.

Unverdorben's Analysis.

1. Volatile oil, which readily distils.
2. Volatile oil, which distils less readily, and has a tendency to resinify.
3. Succinic acid (small quantity).
4. Much pinic acid
5. A little sylvic acid.
6. Indifferent resin, insoluble in oil of petroleum.
7. Bitter extractive.

Old Venice Turpentine.

Fresh Venice Turpentine.

Larch resin yields, according to Berzelius,⁷ from 18 to 25 per cent. (according to Guibourt only 15 to 24 per cent.) of volatile oil which possesses the power of left-handed circular polarization. Its odour is citron-like, and on this account the oil might be substituted for essence of lemons in the preparation of *scouring drops*. Its sp. gr. is 0.863.

3. STRASBURG TURPENTINE (*Terebinthina argentoratensis*; *Térébenthine au citron, ou Térébenthine d'Alsace*, Guib.)—This is obtained from *Abies Picea*. The peasantry, in the vicinity of the Alps, collect it by puncturing the vesicles adhering to the bark with sharp-pointed hooks, and receiving the juice in a bottle. It is afterwards filtered through a rude kind of bark funnel.⁸

Strasburg turpentine is very fluid, transparent, of a yellowish colour, has a very agreeable odour of citron, and a taste moderately acrid and bitter. It consists, according to Caillot,⁹ of volatile oil 33.5, resin insoluble in alcohol 6.20, abietin (a crystallizable resin) 10.85, abietic acid (? pinic and sylvic acids) 46.39, extractive and succinic acid 0.85, loss (principally volatile oil) 2.21.

4. CANADIAN TURPENTINE, or *Canada Balsam* (*Terebinthina canadensis*; *Balsamum canadense*), is obtained from *Abies balsamea* in Canada and the State of Maine. Between the bark and the wood of the trunks and branches of these trees are vesicles containing this oleo-resin, which exudes when they are broken, and is received in a bottle. It is imported in casks containing each about one cwt. When fresh it has the consistence of thin honey, but by age gradually solidifies: it is yellow, transparent, very tenacious, of a peculiar and agreeable terebinthinate odour, and of a slightly bitter, somewhat acrid, taste. Like Bordeaux turpentine, it solidifies when mixed with a sixth of its weight of calcined magnesia. It is imperfectly soluble in alcohol.

Canada balsam has been analyzed by Bonastre,¹⁰ who obtained the following

¹ Guib. MSS.

² Hist. Nat. lib. xvi. cap. 19. ed. Valp.

³ Dr. Maton, in Lambert's Description of the Genus Pinus; and Dr. A. T. Thomson, London Dispensatory.

⁴ Berzelius, *Traité de Chim.* t. v. p. 477; and Gmelin, *Hand. d. Chim.*

⁵ Berzelius, *op. cit.*

⁶ Duhamel, *Traité des Arbres*, t. i. p. 39.

⁷ Journ. de Pharm. viii. 337.

⁸ Idem. Hist. des Drog. 3me éd. t. ii. p. 577.

⁹ United States Dispensatory.

¹⁰ Journ. de Pharm. xvi. p. 436.

results: *volatile oil* 18.6, *resin* easily soluble in alcohol 40.0, *subresin* difficultly soluble 33.4, *fibrous caoutchouc*, like subresin, 4.0, *acetic acid* traces, *bitter extractive* and *salts* 4.0.

Balsam of Canada possesses the property of right-handed circular polarization; but both the oil and resin, into which it is resolved by distillation, have left-handed polarization.¹

Canada balsam is used by varnish-makers, by opticians as a cement, and by microscopists as a medium for mounting objects in.

The great value of Canada balsam for optical purposes depends on its transparency and its refractive power, which is nearly equal to that of glass. When used to connect the pieces of an achromatic lens, it prevents the loss of light by reflexion, and excludes moisture and other foreign bodies from the space between the surfaces of the glasses. In Nicol's prisms (single image prisms of Iceland spar), it serves the important purpose of transmitting the ordinary ray and of interrupting the passage of the extraordinary one; its index of refraction being intermediate between that of Iceland spar for the ordinary ray and that of the same substance for the extraordinary ray. The following table of indices of refraction serves to illustrate the preceding statements:—

Indices of Refraction.		Indices of Refraction.	
Canada balsam	1.528 to 1.549	Flint glass	1.576 to 1.612
Plate glass	1.500 to 1.550	Iceland spar, ordinary ray	1.634
Crown glass	1.525 to 1.544	Iceland spar, extraordinary ray .	1.483

5. COMMON FRANKINCENSE (*Abietis resina*; *Thus*).—This is the spontaneous exudation of *Abies excelsa*. I am indebted for an authentic sample of this oleo-resin to Mr. Daniel Hanbury, who collected it, in the autumn of 1849, from the *A. excelsa*, in Switzerland. It is a soft solid, glistening in places, as if covered with a film of water. Its colour is not uniform: it is whitish, yellowish, pinkish, or pale violet red, and dark in different portions. The pinkish or violet red or peach-blossom hue seems to have been produced by exposure of the resin to the air and light, and in this circumstance resembles the peach-blossom red colour which assafetida acquires under similar circumstances. It is probable, however, that this tint is not permanent. Its odour is not disagreeable, but is somewhat like that of Strasburg turpentine. Guibourt says it is analogous to that of castoreum. The taste is balsamic, and without any bitterness.

When melted in water, and strained through a coarse cloth, it forms *Burgundy pitch* (*pix abietina vel burgundica*; *poix jaune ou blanche*). An authentic sample, prepared by Mr. D. Hanbury from *thus* collected by himself, is of an opaque whitish-yellow colour, somewhat resembling emplastrum plumbi.

The substance sold as common frankincense in the London shops is usually concrete American turpentine; and most of the so-called Burgundy pitch found in commerce is a fictitious article.

Common frankincense or *thus* has been analyzed by Caillot,² who obtained the following results: *volatile oil* 32.00, *resin* insoluble in alcohol 7.40, *abietin* (a crystallizable resin) 11.47, *abietic acid* (? pinic and sylvic acids) 45.37, *extractive* and *succinic acid* 1.22, *loss* (principally volatile oil) 2.54.

PHYSIOLOGICAL EFFECTS.—The effects of terebinthinate substances have been before noticed (see vol. i. p. 254). Locally they operate as irritants. Applied to the skin they cause rubefaction, and sometimes a vesicular eruption. Swallowed they give rise to a sensation of warmth at the stomach, in large doses occasion sickness, and promote the peristaltic movement of the intestines. After their absorption they operate on the general system as stimulants, and excite the vascular system, especially of the abdominal and pelvic viscera. Their influence is principally directed to the secreting organs, more especially to the mucous membranes and the urinary apparatus. They act as diuretics, and communicate a violet odour to the urine. This odour depends on a portion of the oil having undergone a slight change in its nature during its passage through the system. Part of the oil, however, is thrown

¹ See a paper by the author, in the *Pharmaceutical Journal*, vol. v. p. 67, 1845.

² *Journ. de Pharm.* t. xvi. p. 436.

off unchanged; for Moiroud¹ has observed that, at the same time that the turpentine cause a violet odour, they flow in part with the urine. "I have verified," says he, "this double phenomenon on many horses, to whom turpentine has been given, for some days, in the enormous dose of ten or twelve ounces." But the kidneys are not the only parts engaged in getting rid of the absorbed turpentine. All the secreting organs, but more especially the bronchial surfaces and the skin, are occupied in the same way. By these the oil is exhaled apparently unchanged, or at least with its usual odour. During the circulation of the terebinthinate particles in the system, they exercise a local influence over the capillaries and secerning vessels, in the vital activity of which they effect a change. In certain morbid conditions, this change is of a most salutary nature. In catarrhal affections of the mucous membranes the secerning vessels become constricted under the use of terebinthines, and the discharge is, in consequence, checked.

The most important, because by far the most active, constituent of the terebinthinate oleo-resins is volatile oil. Hence their effects are almost identical with those of the latter, and will be noticed hereafter (see p. 1193). Some slight differences, however, are to be noticed. They are less rapidly absorbed, are more permanent in their operation, confine their influence principally to the apparatus of organic life, not affecting, at least to the same extent, the brain, and act less powerfully on the cutaneous system.

We have few data on which to rely in judging of the comparative influence of the different terebinthines; but as their most active constituent is volatile oil, we may fairly infer that those which possess the greatest liquidity, and which, in consequence, contain the largest quantity of oil, are the most powerful preparations. *Venice* and *Strasburg* turpentine stand in this respect pre-eminent. *Canada balsam* is valuable on account of its purity and agreeable flavour. In activity, purity, and flavour, *common turpentine* holds the lowest rank.

USES.—The terebinthinate oleo-resins are, with some exceptions, applicable for the same purposes as the volatile oil. The following are the principal cases in which they are employed:—

1. *In mucous discharges from the urino-genital organs; as gonorrhœa, gleet, leucorrhœa, and chronic cystirrhœa.*
2. *In chronic catarrh, both mucous and pituitous, occurring in old persons of a lax fibre and lymphatic temperament.*
3. *In chronic mucous diarrhœa, especially when accompanied with ulceration of the mucous follicles.*
4. *In colic and other cases of obstinate constipation, Cullen² found a turpentine emulsion used as a clyster "one of the most certain laxatives."*
5. *In chronic rheumatism, especially sciatica and lumbago, the turpentine are occasionally used.*
6. *As detergents and digestives they have been sometimes applied to indolent and ill-conditioned ulcers.*

ADMINISTRATION.—The dose of the terebinthinate oleo-resins is from a scruple to a drachm. They are given in the form of *pill*, *emulsion*, or *electuary*. To communicate to the softer kinds a consistence fit for making pills, liquorice powder may be added to them. Bordeaux turpentine and balsam of Canada, mixed with about one twenty-eighth part of their own weight of calcined magnesia, solidify in about twelve hours; the acid resins combine with the magnesia, and form solid resinates, which absorb the volatile oil. A turpentine emulsion is made with the yolk of egg, or mucilage of gum Arabic, sugar, and some aromatic water. To form an electuary the turpentine is mixed with sugar or honey. An emulsion, containing from half an ounce to an ounce of turpentine, may be used as a clyster, in obstinate constipation, ascarides, &c.

¹ *Pharmacol.-Vétérin* p. 312.

² *Treat. of the Mat. Med.*

The terebinthinate oleo-resins yield several officinal substances, and enter into several preparations:—

1. *TEREBINTHINA VULGARIS* yields *Oleum Terebinthinæ* and *Resina*; and enters into the composition of *Emplastrum Galbani*, L., and *Unguentum Elemi*, L.
2. *TEREBINTHINA VENETA* is a constituent of *Emplastrum Cantharidis compositum*, E., and *Unguentum Infusi Cantharidis*, E.
3. *ABIEtis RESINA*; THUS, yields *Pix Burgundica*, L. E. D.; and enters into the composition of *Emplastrum Galbani*, L., *Emplastrum Opii*, L., *Emplastrum Picis*, L., *Emplastrum Calafaciens*, D., *Emplastrum Ferri*, L. D., and *Emplastrum Cumini*, L.

2. *Oleum Terebinthinæ*, E. D.—Oil of Turpentine.

This essential oil is frequently, though erroneously, called *spirits* or *essence* of *turpentine*.

PREPARATION.—It is obtained by submitting to distillation a mixture of American turpentine (which has been melted and strained) and water in due proportions, in the ordinary copper still, with a naked fire. The distilled product is found to consist of oil of turpentine swimming on water; the residue in the still is resin. If no water be employed, a much higher temperature is required to effect the distillation, and danger is thereby incurred of causing empyreuma. Mr. Flockton, a large distiller of turpentine in this metropolis, informs me that the average quantity of oil yielded by American turpentine is from 14 to 16 per cent. He also tells me that Bordeaux turpentine yields an oil having a more disagreeable odour, and a resin of inferior quality.

To deprive it of all traces of resinous and acid matters, oil of turpentine should be redistilled from a solution of potash, and this is actually done, as Mr. Flockton informs me. The British Colleges, however, direct it to be purified by distillation with water only.

The directions of the Edinburgh College for the preparation of Rectified Oil of Turpentine (*Oleum Terebinthinæ purificatum*, E.), are as follows:—

Take of Oil of Turpentine Oj; Water Oiv. Distil as long as oil comes over with the water.

The London College gives no directions for the rectification of the oil; but places the rectified oil (*oleum e terebintho destillatum, rectificatum*, L.).

PROPERTIES.—Pure oil of turpentine is a colourless, limpid, very inflammable fluid. It has a peculiar, and, to most persons, disagreeable odour, and a hot taste. When pure, it is neutral to test paper. Its sp. gr. is 0.86 at about 70° F. It boils at about 314° F.; the density of its vapour is 4.76 (Dumas). It is very slightly soluble in hydrated alcohol; but 100 parts of alcohol, of sp. gr. 0.840, dissolve 13 or 14 parts of it, and absolute alcohol takes up a still larger proportion. The oil is also soluble in ether. Exposed to the air, it absorbs oxygen, becomes yellowish, and somewhat denser, owing to the formation of resin (*pinic* and *sylvic acids*). This resinification is accompanied with the production of a small quantity of formic acid.

Oil of turpentine enjoys the power of rotating the ray of plane-polarized light; but the direction of rotation is different in the English and French oils—in the former being right-handed, in the latter left-handed.

Plan of the apparatus for showing the circular polarization of oil of turpentine.

- a. A ray of common or unpolarized light.
- b. A glass reflector, placed at an angle of $56^{\circ}.45'$, for effecting the plane-polarization of the light.
- c. The reflected plane-polarized ray.
- d. The oil of turpentine, which effects the double refraction and rotation of the plane-polarized light.
- e. The emergent circularly-polarized light.
- f. The analyzer (a double refracting rhomb of calcareous spar), which produces two-coloured images: one caused by ordinary refraction, and called the *ordinary image* (o); the other by extraordinary refraction, and termed the *extraordinary image* (x).
- g. A lens employed to produce well-defined images.

When the eye is applied to the aperture above or in front of the lens g, two circular disks of coloured light (Fig. 281) are perceived; one (o) the

Fig. 280.

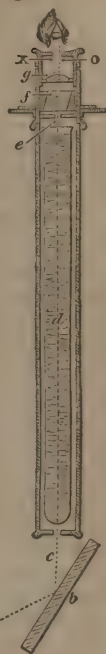


Fig. 281.



Ordinary and extraordinary images.

ordinary, the other (x) the extraordinary image. The colours of these images are complementary to each other. By rotating the analyzer (f) on its axis, the extraordinary image (x) revolves around the ordinary image (o); each image undergoing a succession of changes of colour; the sequence of colours being different for the English and French oils of turpentine.

SEQUENCE OF COLOURS FOR OIL OF TURPENTINE AS OBTAINED BY THE RIGHT-HANDED ROTATION OF THE ANALYZER.

English Oil of Turpentine. (Obtained from American turpentine, the produce of <i>Pinus palustris</i> and <i>P. taeda</i> .)		French Oil of Turpentine. (Obtained from Bordeaux turpentine, the produce of <i>Pinus Pinaster</i> .)	
Ordinary Image.	Extraordinary Image.	Ordinary Image.	Extraordinary Image.
Red	Green.	Red	Green.
Orange	Blue.	Violet }	Yellow.
Yellow	{ Indigo.	Blue	Orange.
Green	{ Violet.	Green	Red.
Blue	Red.	Yellow	{ Violet.
Indigo }	Orange.	Orange	{ Indigo.
Violet }	Yellow.	Red	Blue.
Red	Green.		Green.

Moreover, the degree of rotatory power is not uniform.

English oil of turpentine (obtained by distillation with water from American turpentine) is remarkable for its comparatively feeble odour. A sample of oil whose sp. gr. was 0.863, had a molecular power of right-handed rotation of 18.5 to 18.7.

French oil of turpentine (obtained by distillation from Bordeaux turpentine) enjoys the power of left-handed rotation; the intensity of which, however, is subject to some variation, as the following table shows:—

	Sp. Gr.	Left-handed Rotatory Power.
Unrectified oil	0.8406	28.83
First product of the rectification with water	0.8736	31.657
Later product of the rectification with water	0.889	22.327
Oil rectified without water	0.873	32.23
Oil rectified without water preserved 10 years with potash	0.87	33.95

It is obvious, therefore, that the molecular constitution of oil of turpentine is not constant.

Bouchardat found that the unrectified oil was an imperfect solvent of caoutchouc; and the oil rectified without water a better one. But the same oil distilled from bricks was pyrogenous, had a slight lemon-yellow colour, a sp. gr. of 0.8422, a rotatory power of only $8^{\circ}.68$, and a much increased power of dissolving caoutchouc.

Rectified oil of turpentine is sold in the shops under the name of *camphene*, for burning in lamps. When it has become resinified by exposure to the air, it is unfit for the purposes of illumination, and requires to be rectified from carbonate of potash, or some similarly active substance, to deprive it of resin.

The *sweet oil of turpentine* or *sweet spirits of turpentine*—sold in the shops for “painting without smell”—does not appear to differ from the rectified oil of turpentine of English commerce.

The common or unrectified oil of turpentine, sold in the shops under the name of *turps*, contains resin, and is, in consequence, denser and more viscid than camphene. Its sp. gr. varies from 0.87 to 0.884.

Oil of turpentine is composed of

	Atoms.	Eq. Wt.	Per Cent.
Carbon	20	120	88.23
Hydrogen	16	16	11.76
Oil of Turpentine	1	136	99.99

Hydrates of oil of turpentine.—Four hydrates of oil of turpentine are known. When the commercial oil is exposed to an intense cold, crystals either of the binhydrate $C^{20}H^{16}, 2H_2O$, or of the hexahydrate $C^{20}H^{16}, 6H_2O$, are deposited. The latter forms large prismatic crystals, which, at a temperature of about $217\frac{1}{2}^{\circ} F.$, became converted into the quadhydrate $C^{20}H^{16}, 4H_2O$. The monohydrate, $C^{20}H^{16}, H_2O$, is a liquid which List calls *terpinol*.

Hydrochlorate of oil of turpentine; Artificial Camphor.—When hydrochloric acid is passed into oil of turpentine, surrounded by ice, two compounds are obtained—one solid, called *solid* or *Kind's artificial camphor*; the other fluid, and termed *liquid artificial camphor*, *terebene*, or *terebylene*.

Solid artificial camphor, $C^{20}H^{16}, HCl$, is white, transparent, lighter than water, and has a camphoraceous taste. It is neutral to test paper, fuses at a temperature above the boiling point of water, and is volatilizable usually with the evolution of hydrochloric acid. It burns in the air with a greenish sooty flame; and when the flame is blown out, evolves a vapour which has a terebinthinate odour. Distilled with lime, it yields chloride of calcium, water, and a volatile oil called *camphilene*, which is isomeric with oil of turpentine, but has no rotatory power in relation to polarized light.

The quantity of solid artificial camphor yielded by oil of turpentine depends on the sort of oil employed. From Thenard's experiments, it would appear that French oil of turpentine yields the largest produce.

Artificial camphor does not produce the lesion of the nervous system which is caused by ordinary camphor. Orfila found that half an ounce of it, dissolved in olive oil, and given to a dog, caused merely a few small ulcers in the mucous membrane of the stomach.

CHARACTERISTICS OF OIL OF TURPENTINE.—As a volatile oil, it is recognized by its combustibility, its burning with a very sooty flame, its almost insolubility in water, its solubility in alcohol and in ether, its volatility, and its evaporating without leaving any greasy stain on paper.

It is sometimes used to adulterate other more costly volatile oils; and it may then be detected by one or more of the following characters: 1st, its remarkable odour; 2dly, its rotatory power in relation to polarized light; 3dly, its being only very slightly soluble in diluted spirit; 4thly, its ready admixture with, and solubility in, the fixed oils; 5thly, its not being able to dissolve, in the cold, santaline (the colouring principle of the wood of *Pterocarpus santalinus*), whereas some of the other

volatile oils (as oil of lavender) do dissolve it; 6thly, by the violent action of both chlorine and iodine on it.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Plants exposed to the vapour of this oil are rapidly destroyed.¹

β. On Animals.—On both vertebrated and invertebrated animals it operates as a poison. Injected into the veins of horses and dogs it excites pneumonia.² Two drachms thrown into the veins of a horse caused trembling, reeling, falling, inclination to pass urine and stools, and frequent micturition. Inflammatory fever, with cough, continued to the 8th day; then putrid fever appeared. On the 9th day death took place. The body presented all the signs of putrid fever and pneumonia (Hertwich). Schubarth³ found that two drachms of the rectified oil, given to a dog, caused tetanus, failure of the pulse and breathing, and death in three minutes. The skin of the horse is very sensible to the influence of oil of turpentine, which produces acute pain. "It is a remarkable circumstance," says Moiroud,⁴ "that this pain is not accompanied with any considerable hyperæmia. It is quickly produced, but is of short duration." Oil of turpentine is sometimes employed by veterinarians as a blister, but it is inferior to cantharides, and, if frequently applied, is apt to blenish (*i. e.*, to cause the hair of the part to fall off). In doses of three ounces it is a most valuable antispasmodic in the colic of horses.⁵ In small doses it acts as a diuretic. Tiedemann and Gmelin⁶ detected oil of turpentine in the chyle of a dog and a horse, to whom this agent had been given.

γ. On Man.—In *small doses* (as six or eight drops to fʒj) it creates a sensation of warmth in the stomach and bowels, becomes absorbed, circulates with the blood, and in this way affects the capillary vessels, and is thrown out of the system by the different excretories, on the secreting vessels of which it acts in its passage through them. The exhalations of the skin and bronchial membranes acquire a marked terebinthinate odour, while the urine obtains the smell of violets. By its influence on the renal vessels it proves diuretic. By the same kind of local influence on the cutaneous vessels it proves sudorific. It appears to have a constringing effect on the capillary vessels of the mucous membranes, for, under its use, catarrhal affections of, and hemorrhages from, these parts are frequently checked, and often are completely stopped. Its continued use sometimes brings on irritation of the urinary organs, or when this state pre-existed, it is often aggravated by the use of turpentine.

In a *medium dose* (fʒj or fʒij) its effects are not constant. Dr. Ed. Percival⁷ saw two drachms given without any unpleasant effect being produced either on the digestive or urinary organs; they acted as an agreeable stomachic, and promoted the catamenia. Mr. Stedman,⁸ on the other hand, has seen this dose produce strangury, bloody urine, suppression of this secretion, fever, thirst, and vomiting. These two cases, however, may be regarded as the opposite extremes; and, in general, we may expect, from a medium dose, a feeling of heat in the stomach and bowels, accelerated peristaltic motion, increased frequency of pulse, diaphoresis, diuresis, and sometimes irritation of the urinary organs. Occasionally it provokes the catamenia.

In a *large or maximum dose* (fʒiv to fʒij) its effects are not constant. It usually causes a sensation of abdominal heat, sometimes nauseates, and in general operates as a tolerably active purgative, without causing any unpleasant effects. I have administered from one to two fluidounces in a considerable number of cases of tape-worm, and have rarely seen any ill consequences therefrom. "It has been given," says Dr. Duncan,⁹ "even to the extent of four ounces in one dose, without any perceptible bad effects, and scarcely more inconvenience than would follow from an equal quantity of gin." Cases are reported, however, in which it has failed to

¹ De Caudolle, *Phys. Vég.* p. 1347.

² Hertwich and Gaspard, quoted by Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. iv. p. 212.

³ Wibmer, *op. cit.*

⁴ *Pharm.-Vétér.* p. 314.

⁵ Youatt, *The Horse*, in *Library of Useful Knowledge*.

⁶ *Versuch u. d. Wege auf welch. Subst. ins Blut gelang.*

⁷ *Ed. Med. and Surg. Journ.* vol. ix.

⁸ *Edinb. Med. Essays*, vol. ii. p. 42.

⁹ *Edinb. Dispensatory*.

produce purging, and in such it has acted most violently on the system, accelerating the pulse, depressing the muscular power, and giving rise to a disordered state of the intellectual functions, which several persons have compared to intoxication. A remarkable and well-detailed instance of this occurred in the person of Dr. Copland,¹ who refers the disorder of the cerebral functions, in his case, to diminished circulation of blood in the brain; while the gastric heat, &c., he ascribes to increased vascular activity in the abdominal region. The oil passed off most rapidly by the skin and lungs (principally by the latter), and the air of the apartment became strongly impregnated with its effluvia. In some cases it causes sleepiness. Purkinje² experienced this effect from one drachm of the oil. Dr. Duncan has sometimes seen it produce "a kind of trance, lasting twenty-four hours, without, however, any subsequent bad effect." The same writer adds, "the largest dose I have known given has been three ounces, and without injury." A scarlet eruption is mentioned by Wibmer as being produced in one case by an ounce of the oil.

USES.—The following are the principal uses of the oil of turpentine:—

1. *As an anthelmintic.*—It is the most effectual remedy for *tape-worm* we possess. It both causes the death of, and expels the parasite from the body. To adults it should be given in doses of an ounce at least. I have frequently administered an ounce and a half, and sometimes two ounces. Occasionally, as in Dr. Copland's case, it fails to purge, but becoming absorbed, operates most severely on the system, causing disorder of the cerebral functions. It is said to be more apt to act thus in persons of a full and plethoric habit. To prevent these ill consequences, an oleaginous purgative should be either conjoined with it, or given at an interval of four or five hours after it. An excellent and safe method of employing it is to combine it with a castor-oil emulsion. *Chabert's empyreumatic oil* (described at vol. i. p. 263) used by Bremser³ against *tape-worm*, consists principally of oil of turpentine. A very effectual remedy for the *small thread-worm* (*Ascaris vermicularis*) is the turpentine enema.

2. *In blennorrhœa.*—Oil of turpentine sometimes checks or stops profuse chronic discharges from the mucous membranes. It appears to effect this by a topical influence over the capillary and secerning vessels, in its passage through them out of the system. In many cases, it would appear to confine its operation to the production of an increase of tonic in the vessels which pour out mucus; but in other instances, especially in blennorrhœa of the urinary apparatus, it seems to set up a new kind of irritation in the affected membrane, which supersedes the previously existing disease. Hence its use is not admissible in acute or recent affections of these tissues. In gonorrhœa and gleet I have frequently employed it as a substitute for balsam of copaiba with success. In leucorrhœa it has occasionally proved serviceable. In catarrhus vesicæ or cystirrhœa, it now and then acts beneficially; but it requires to be used in small doses and with great caution. In chronic pulmonary catarrh, either mucous or pituitous, it is said to have been employed with advantage. In chronic diarrhœa and dysentery it has proved advantageous: in these cases it has a direct local action on the affected part, besides exerting its influence over this in common with other mucous membranes after its absorption.

3. *In hemorrhages.*—In sanguineous exhalations, called hemorrhages, from the mucous surfaces, oil of turpentine may, under some circumstances, act efficaciously. On the same principle that it checks excessive secretion of mucus in catarrhal conditions of these tissues, so we can readily conceive it may stop the exhalation of blood. But it is only admissible in cases of a passive or atonic character, in the absence of plethora and a phlogistic diathesis.⁴ In purpura hæmorrhagica it has been recommended as a purgative, by Dr. Whitlock Nichol,⁵ Dr. Magee,⁶ and others.

¹ *Lond. Med. and Phys. Journ.* vol. xlvii. p. 107.

² *Traité sur les Vers Intest.* p. 488.

³ *Adair, Med. Facts and Observ.* vol. iv. p. 25; *Copland, Lond. and Med. Phys. Journ.* vol. xlvii. p. 194.

⁴ *Ed. Med. and Surg. Journ.* vol. xviii. p. 510.

⁵ Quoted by Wibmer, *Wirk. d. Arzn.*

⁶ *Ibid.* vol. xxiv. p. 307.

I have seen it act injuriously in this disease, while blood-letting has seemed to relieve.

4. *In puerperal fever.*—The use of the oil of turpentine as a specific in this disease was introduced by Dr. Brennan, of Dublin;¹ and strong testimonies were subsequently borne to its efficacy by several highly respectable practitioners.² Dr. Brennan gave one or two tablespoonfuls of the oil, every three or four hours, in cold water, sweetened; and applied flannel soaked in the oil to the abdomen. But the apparent improbability of a stimulant like turpentine curing an inflammatory disease, has prevented many practitioners placing any faith in it, or even giving it a trial. In other instances, the unconquerable aversion which patients have manifested to it, has precluded its repetition. Lastly, it has failed, in the hands of some of our most accurate observers, to produce the good effects which Dr. Brennan and others have ascribed to it, and in some instances has appeared to aggravate the malady. These reasons have been conclusive against its employment, at least in the way advised by Dr. Brennan. But there are two valuable uses which may be made of turpentine, in puerperal fever: it may be given in the form of clyster, to relieve a tympanitic condition of the intestines, and for this purpose no remedy perhaps is superior to it; secondly, flannel soaked in the hot oil may be applied to the abdomen, to cause rubefaction, as a substitute for a blister, to the employment of which several objections exist.

5. *In ordinary fever.*—As a powerful stimulant in some forms of low fever, oil of turpentine has been well spoken of by Dr. Holst,³ Dr. Chapman,⁴ Dr. Douglas,⁵ and more recently by Dr. Wood.⁶ When the skin is dry, the bowels flatulent, and ulceration of the mucous membrane suspected, it often proves most serviceable.

6. *In rheumatism.*—In chronic rheumatism, oil of turpentine has long been celebrated. Its beneficial influence depends on its stimulant and diaphoretic operation, and is more likely to be evinced in old and debilitated persons. I have found medium doses occasionally succeed when small ones have failed. But for the most part I have not met with that success with it in chronic rheumatism, to induce me to place much confidence in it. In the form of liniment it has often proved serviceable.

7. *In sciatica and other neuralgic affections.*—Oil of turpentine was proposed as a remedy for sciatica by Drs. Pitcairn and G. Cheyne. Its efficacy was subsequently confirmed by Dr. Home.⁷ More recently it has been extensively employed, and with great success, in France, in sciatica as well as in various other neuralgias.⁸ But it has proved more successful in those which affect the lower extremities. My own experience does not lead me to speak very favourably of it. In a disease the pathology of which is so imperfectly understood as is that of neuralgia, it is vain to attempt any explanation of the *modus medendi* of an occasional remedy for it. I have known oil of turpentine now and then act most beneficially in sciatica, without giving rise to any remarkable evacuation by the bowels, skin, or kidneys, so that the relief could not be ascribed to a cathartic, a diaphoretic, or a diuretic operation.

8. *In suppression of urine.*—I have seen oil of turpentine succeed in reproducing the urinary secretions when other powerful diuretics had failed.

9. *In infantile diabetes.*—Dr. Dewees⁹ has cured three cases of diabetes (?) in infants under fifteen months old “by keeping the bowels freely open, and putting a quantity of spirits of turpentine upon the clothes of the children, so as to keep them in a terebinthinate atmosphere.”

10. *In nephritic diseases.*—In some diseases of the kidneys, as ulceration, the use of oil of turpentine has been much extolled. It has proved successful in renal hydratis.¹⁰

¹ *Thoughts on Puerperal Fever, and its cure by Spirits of Turpentine*, Lond. 1814.

² Vide Bayle, *Bibl. Therap.* t. iv.

³ *Elem. of Therap.* 4th edit. vol. ii. p. 129

⁴ *North Amer. Med. and Surg. Journ.* April, 1826.

⁵ *Martinet, Lond. Med. and Phys. Journ.* March, 1829; Bayle, *Bibl. Therap.* t. iv.

⁶ *Treatise on the Physical and Moral Treatment of Children.*

⁷ *Hufeland's Journ.* Bd. 20, St. 2, S. 146.

⁸ *Dubl. Hosp. Rep.* vol. iii.

⁹ *Clin. Experiments.*

¹⁰ Bayle, *op. cit.*

11. *In dropsy*.—Oil of turpentine has occasionally proved serviceable in the chronic forms of this disease.¹ Its efficacy depends, in part, on its derivative operation as a stimulating diuretic; and in part, as I conceive, on its powerful influence over the capillary and secreting vessels, by which it exercises a direct power of checking effusion. It is inadmissible, or is contraindicated, in dropsies accompanied with arterial excitement, or with irritation of the stomach or the urinary organs. When the effusion depends on obstruction to the return of venous blood, caused by the pressure of enlarged or indurated viscera, tumours, &c., turpentine can be of no avail. But in the atonic forms of dropsy, especially in leucophlegmatic subjects, attended with deficient secretion of the skin and kidneys, this oil is calculated to be of benefit. Dr. Copland² has used it in the stage of turgescence, or invasion of acute hydrocephalus, as a drastic and derivative.

12. *In spasmodic diseases*.—Oil of turpentine has been employed successfully in the treatment of epilepsy, by Drs. Latham, Young, Ed. Percival, Lithgow, Copland, and Pritchard.³ No benefit can be expected from this or any other medicine, when the disease depends on organic lesion within the osseous envelops of the nervous centres. But when the disease is what Dr. Marshall Hall terms *centripetal* or *eccentric* (as the convulsion of infants frequently is), that is, takes its origin in parts distant from the cerebro-spinal axis, which becomes affected only through the incident or excitor nerves, we can easily understand that benefit may be obtained by the use of agents like this, which, while it stimulates the abdominal viscera, operates as a cathartic and anthelmintic, and produces a derivative action on the head. A more extended experience of its use in chorea, hysteria, and tetanus, is requisite to enable us to speak with confidence of its efficacy in these diseases, though a few successful cases have been published.⁴

13. *In inflammation of the eye*.—Mr. Guthrie⁵ has employed oil of turpentine in inflammation of the iris and choroid coat, on the plan recommended by Mr. Hugh Carmichael.⁶ In some cases, especially those of an arthritic nature, it succeeded admirably, in others it was of little or no service. It was given in doses of a drachm three times a day.

14. *In tympanites*.—To relieve flatulent distension of the stomach and bowels, and the colic thereby induced, both in infants and adults, oil of turpentine is a most valuable remedy. It should be given in full doses, so as to act as a purgative; or when, from any circumstance, it cannot be exhibited by the mouth, it may be employed in the form of clyster. Dr. Ramsbotham⁷ speaks in the highest terms of the efficacy of the oil of turpentine in the acute tympanites of the puerperal state, and thinks that most of the cases of the so-called puerperal fever, which yielded to this oil, were in fact cases of acute tympanites; and in this opinion he is supported by Dr. Marshall Hall.

15. *In obstinate constipation*.—Dr. Kinglake,⁸ in a case of obstinate constipation, with a tympanitic condition of the intestines, found oil of turpentine a successful cathartic, after the ordinary means of treating these cases had been assiduously tried in vain. Dr. Paris⁹ also speaks highly of it in obstinate constipation depending on affections of the brain.

16. *To assist the passage of biliary calculi*.—A mixture of three parts sulphuric ether and two parts oil of turpentine has been recommended as a solvent for biliary calculi.¹⁰ But there is no foundation for the supposition that the relief which may be obtained by the use of this mixture in icterus, and during the passage of a biliary calculus, depends on the dissolution of the latter.

¹ See the authorities quoted by Dr. Copland, *Lond. Med. and Phys. Journ.* vol. xlvii. p. 201.

² *Op. cit.* p. 202.

³ Copland's *Dict. of Pract. Med.* p. 806.

⁴ Copland, *Lond. Med. and Phys. Journ.* vol. xlvii. p. 199; Phillips, *Med.-Chir. Trans.* vol. vi.; Elliotson, *Lancet*, May, 1830; Gibbon, *Lond. Med. Gaz.* vol. vii. p. 428.

⁵ *Lond. Med. Gaz.* vol. iv. p. 509.

⁶ *Loc. cit.* vol. v. p. 836.

⁷ *Lond. Med. Gaz.* vol. xvi. p. 118.

⁸ *Lond. Med. and Phys. Journ.* vol. xlvii. p. 272.

⁹ *Pharmacologia*.

¹⁰ Durande, *Observ. sur l'Efficacité du Mélange d'Ether sulph. et d'Huile volatile de Téréb. dans Coliques hépat. produites par des Pierres Biliaires*, 1790.

17. *As an external remedy.*—Oil of turpentine is employed externally, as a *rube-facient*, in numerous diseases, on the principle of counter-irritation, before explained (vol. i. p. 170). Thus in the form of liniment, it is used, either hot or cold, in chronic rheumatism, sprains, sore throat, neuralgic affections of the extremities, &c. In the form of fomentation the hot oil is applied to produce redness of the skin in puerperal peritonitis, as I have already mentioned. As a powerful local *stimulant*, it was recommended by Dr. Kentish¹ as an application to burns and scalds, his object being to restore the part gradually, not suddenly, to its natural state, as in the treatment of a case of frost-bite. The practice is most successful when the local injury is accompanied with great constitutional depression. I can bear testimony to its efficacy in such cases, having employed it in several most severe and dangerous burns with the happiest results. In that form of gangrene which is not preceded by inflammation, and is called *dry or chronic*, oil of turpentine may occasionally prove serviceable, especially when the disease affects the toes and feet of old people. There are many other topical uses to which it has been applied; but as they are for the most part obsolete, at least in this country, I omit any further mention of them. They are fully noticed in the works of Voigtels² and Richter.³ Oil of turpentine is the principal ingredient in *Whitehead's Essence of Mustard*, which contains also camphor and a portion of the spirits of rosemary. *St. John Long's liniment* consisted of oil of turpentine and acetic acid, held in suspension by yolk of egg.⁴

ADMINISTRATION.—When given as a diuretic, and to affect the capillary and secreting vessels (in catarrhal affections of the mucous membranes, dropsy, suppression of urine, hemorrhage, &c.) the dose is from six or eight minims to fʒj; as a general stimulant (in chronic rheumatism, chorea, &c.) or to produce a change in the condition of the intestinal coats (in chronic dysentery), from fʒj to ʒij; as an anthelmintic (in tape-worm) or as a revulsive (in apoplexy, in epilepsy previous to an expected paroxysm, &c.), from fʒss to fʒij. It may be taken floating on some aromatic water, to which some hot aromatic tincture, as *tinctura capsici*, has been added; or it may be diffused through water by the aid of mucilage or an emulsion; or it may be made into a linctus with honey or some aromatic syrup.

1. ENEMA TEREBINTHINÆ, L. E. D.; *Clyster of Turpentine*.—(Oil of Turpentine fʒj; the Yolk of one Egg; Decoction of Barley fʒʒix. Rub the oil with the yolk, and add the decoction, *L.*—The *Edinburgh College* substitutes plain Water for Barley Water.—The *Dublin College* orders of Oil of Turpentine fʒj; Mucilage of Barley fʒxvj.)—Used as an anthelmintic in ascarides; as an antispasmodic and purgative in colic, obstinate constipation, and tympanites. Dr. Montgomery⁵ says, “it is much used in cases of peritoneal inflammation.”

2. LINIMENTUM TEREBINTHINÆ, L. D.; *Linimentum Terebinthinatum*, E.; *Turpentine Liniment*.—(Soft Soap ʒij; Camphor ʒj; Oil of Turpentine fʒxvj. “Shake them together until they are mixed,” *L.*—Resinous Ointment ʒiv; Oil of Turpentine fʒv; Camphor ʒss. Melt the ointment, and gradually mix with it the camphor and oil till a uniform liniment be obtained,” *E.*—Ointment of White Resin ʒviij; Oil of Turpentine fʒv, *D.*)—Introduced by Dr. Kentish⁶ as a dressing for burns and scalds. The parts being first bathed with warm oil of turpentine, alcohol, or camphorated spirit, are to be covered with pledgets of lint thickly spread with this liniment. When the peculiar inflammation, excited by the fire, has subsided, milder applications are then to be resorted to. This liniment may also be used in any other cases requiring the employment of a more stimulant application than the ordinary soap liniment.

¹ *Essay on Burns.*

² *Ibid.* Bd. ii. S. 71.

³ *Observations on the Dublin Pharmacopœia.*

⁴ *Arzneimittell.* Bd. ii. S. 260.

⁵ Dr. Maereight, *Lancet*, for 1837–8, vol. ii. p. 485.

⁶ *Essay on Burns.*

3. *Resinæ Terebinthinæ*.—Terebinthinate Resins.1. *Resina*, L. E. D. [U. S.].—*Rosin*, or *Common Resin*.

(Quod restat Terebinthinæ postquam oleum destillatum est, L.)

PREPARATION.—This is the residue of the process for obtaining oil of turpentine. It is run, while liquid, into metallic receivers coated with whiting to prevent adhesion, and from these is ladled into wooden moulds or casks. When the distillation is not carried too far, the product contains a little water, and is termed *yellow rosin* (*resina flava*). A more continued heat expels the water and produces *transparent rosin*; and if the process be pushed as far as it can be without producing a complete alteration of properties, the residue acquires a deep colour, and is termed *brown or black rosin*, or *colophony* (*resina nigra seu colophonium*). If melted rosin be run into cold water contained in shallow tanks, and a supply of cold water be kept up until the rosin has solidified, a pale yellow product is obtained, called *Flockton's patent rosin*.

PROPERTIES.—Rosin is compact, solid, brittle, almost odourless and tasteless, with a smooth, shining fracture, becomes electric by friction, is fusible at a moderate heat, decomposable at a higher temperature, and burning in the air with a yellow smoky flame. It is insoluble in water, but soluble in alcohol, ether, and the volatile oils. With wax and the fixed oils it unites by fusion; with the caustic alkalies it unites to form a *resinous soap* (the *alkaline resins*, principally the *pinates*). Heated with concentrated sulphuric or nitric acid mutual decomposition takes place.

By distillation, rosin yields *rosin oil* and *tar*. *Rosin oil* is a mixture of four carburets of hydrogen: *retinaphte*, $C^{14}H^8$; *retinyle*, $C^{10}H^{12}$; *retinole*, $C^{32}H^{16}$; and *metanaphthaline*, $C^{20}H^8$. The rosin oil which distils over at from $226\frac{1}{2}^{\circ}$ F. to 302° F. is a mixture of retinaphte and retinyle. It is sometimes used in the arts as a substitute for oil of turpentine. The part which boils at about 464° F. is retinole; it enters into the composition of some printing inks. Mixed with lime, it forms a sort of grease for wheels, machinery, &c. Rosin oil has been used in the preparation of *rosin gas*.¹

Yellow rosin is opaque and yellow, or yellowish-white. Its opacity is owing to water, with which it is incorporated. By continued fusion this is got rid of, and the rosin then becomes transparent (*transparent rosin*). *Brown rosin*, or *colophony*, is more or less brown and transparent.

COMPOSITION.—Rosin is a compound or mixture of *pinic acid* (principally), *colophonic acid* (variable in quantity), *sylvic acid* (a small quantity), and traces of an *indifferent resin*.²

Pinic and sylvic acids are isomeric: according to Laurent, their equivalent is expressed by the formula $C^{40}H^{29}O^3, HO$; and their salts by the formula $MO, C^{40}H^{29}O^3$.

1. **PINIC ACID**.—It is soluble in cold alcohol of sp. gr. 0.883. The solution forms a precipitate (*pinate of copper*) on the addition of an alcoholic solution of acetate of copper. *Pinate of magnesia* dissolves with difficulty in water.

2. **COLOPHONIC ACID** (*Colophonic Acid*).—Formed by the action of heat on pinic acid, and therefore the quantity of it contained in rosin varies according to the heat employed. Rosin owes its brown colour to it. It is distinguished from pinic acid by its greater affinity for salifiable bases, and its slight solubility in alcohol.³

3. **SYLVIC ACID**.—Is distinguished from pinic acid by its insolubility in cold alcohol of sp. gr. 0.883.

4. **INDIFFERENT RESIN**.—Is soluble in cold alcohol, oil of petroleum, and oil of turpentine. It forms with magnesia a compound readily soluble in water.

PHYSIOLOGICAL EFFECTS.—Not being used internally, its effects when swallowed are scarcely known. It is probable, however, that they are of the same kind as those of common turpentine, though very considerably slighter. In the horse it

¹ Pelouze and Fremy, *Cours de Chimie générale*, t. iii. p. 543, 1850.

² Unverdorben, in Gmelin, *Hand. d. Chem.* ii. 520.

³ Berzelius, *Traité de Chim.* t. v. p. 489.

acts as a useful diuretic, in doses of five or six drachms.¹ Its local influence is mild. "It may be considered," says Dr. Maton,² "as possessing astringency without pungency."

USE.—Powdered rosin has been applied to wounds to check hemorrhage, and is occasionally used for this purpose in veterinary practice. But the principal value of rosin is in the formation of plasters and ointments, to which it communicates great adhesiveness and some slightly stimulant properties.

1. CERATUM RESINÆ, L. [U. S.]; *Unguentum Resinosum*, E.; *Unguentum Resinæ*, D.; *Yellow Basilicon* or *Basilicon Ointment*, offic.—(Resin, Wax, of each ℥xv ; Olive Oil Oj. Melt the resin and the wax together with a slow fire; then add the oil, and press the cerate, while hot, through a linen cloth, L.—The *Edinburgh College* orders of Resin ℥v ; Axunge ℥viiij ; Bees' Wax ℥ij . Melt them together with a gentle heat, and then stir the mixture briskly while it cools and concretes. [The *U. S. Pharm.* directs the same.]—The *Dublin College* orders of Resin, in coarse powder, ℔ss ; Yellow Wax ℥iv ; Prepared Lime ℔j .)—A mildly stimulant, digestive, and detergent application to ulcers which follow burns, or which are of a foul and indolent character, and to blistered surfaces to promote a discharge.

2. EMPLASTRUM RESINÆ, L. D. [U. S.]; *Emplastrum Resinosum*, E.—Has been already described at vol. i. p. 715.

2. *Pix Burgundica*, L. E. D.—*Burgundy Pitch*.

(*Resina impura e terebinthinâ præparata*, L.)

PREPARATION.—True Burgundy pitch is prepared by melting common frankincense (*Abies resina*; *Thus*) in hot water, and straining through a coarse cloth. By this process part of the volatile oil and the impurities are got rid of. The substance sold as Burgundy pitch in the shops is rarely prepared in this way, but is fictitious. Its principal constituent is rosin, rendered opaque by the incorporation of water, and coloured by palm oil. One maker of it informed me that he prepared it from old and concrete American turpentine.

I have a sample of genuine Burgundy pitch prepared by Mr. D. Hanbury from *Thus* collected by himself in Switzerland (see *ante*, p. 290). In colour it somewhat resembles *emplastrum plumbi*. Its odour resembles the Burgundy pitch imported from *Hamburg*, and which, when strained, constitutes the best commercial Burgundy pitch.

Hamburg Burgundy pitch is of a dark colour, and contains many impurities. It would appear to be melted but unstrained *Thus*. It yields, when re-melted and strained, a Burgundy pitch which is darker coloured, but which otherwise agrees with the genuine sample prepared by Mr. Hanbury.

PROPERTIES.—Genuine Burgundy pitch is hard, brittle when cold, but readily taking the form of the vessel in which it is kept. It softens by the heat of the hand, and strongly adheres to the skin. Its colour is yellowish-white; its odour is not disagreeable; its taste slightly bitter. Fictitious Burgundy pitch is usually of a fuller yellow colour than the genuine, and has a somewhat less agreeable odour.

COMPOSITION.—Consists of *resin* principally and a small quantity of *volatile oil*.

PHYSIOLOGICAL EFFECTS.—Its effects are similar to those of the other terebinthinate resins. In activity it holds an intermediate station between common turpentine and rosin; being considerably less active than the first, and somewhat more so than the last of these substances. Its local action is that of a mild irritant. In some persons it excites a troublesome vesiculo-pustular inflammation.³

USES.—It is employed as an external agent only, spread on leather, forming the well-known *Burgundy pitch plaster* (*emplastrum picis burgundicæ*), which is applied to the chest in chronic pulmonary complaints, to the loins in lumbago, to the joints in chronic articular affections, and to other parts to relieve local pains of a rheumatic character. It acts as a counter-irritant or revulsive.

¹ Youatt, *The Horse*, in the *Library of Useful Knowledge*.

² Rayer, *Treatise on Diseases of the Skin*, by Dr. Willis, p. 366.

³ Lambert's *Pinus*

EMPLASTRUM PICIS, L. E.; *Plaster of Pitch*.—(Burgundy Pitch ℥ij; Frankincense [Thus] ℥ij; Resin, Wax, of each ℥iv; Expressed Oil of Nutmeg ℥j; Olive Oil, Water, of each f℥ij. Add the oils and water to the pitch, resin, and wax, melted together. Lastly, mix them all, and boil down to a proper consistence, *L.*—The formula of the *Edinburgh College* is as follows: Burgundy Pitch ℥jss, Resin and Bees' Wax, of each ℥ij; Oil of Mace ℥ss; Olive Oil f℥j; Water f℥j. Liquefy the pitch, resin, and wax, with a gentle heat; add to the other articles; mix them well together, and boil till the mixture acquires a proper consistence.)—Stimulant and rubefacient; used in the same cases as the simple Burgundy pitch.

[4. *Pix Canadensis, U. S.*

Canada Pitch; Hemlock Pitch; the prepared concrete juice of the Abies Canadensis, Mich.—As a substitute for Burgundy Pitch, this article is employed in the United States, over which it has the advantage of being in a state of purity. It is the product of the

ABIES CANADENSIS, or *Hemlock Spruce*, a large tree, attaining a height of seventy or eighty feet, with a circumference of six or nine feet. The leaves are six or eight lines long, very narrow, flat, and downy at the time of their expansion. The cones are a little longer than the leaves, oval, pendulous, and situated at the extremity of the branches.

This species of *Abies* is solely a native of North America, and belongs to the coldest regions of the continent, beginning to appear about Hudson's Bay. In the vicinity of Lake St. John and near Quebec, the forests are filled with it, and it is found in all the Northern States. It prefers high situations, and those the most humid and gloomy.

The wood of this tree is of little value; the bark contains a large amount of tannin, and is used in the tanneries where the oak is scarce.

Hemlock resin does not flow from the bark by incision, but is invariably the result of spontaneous exudation from knots or excrescences, the heat of the sun bringing it to the surface; and it is always obtained from old trees or those approaching decay. The proportion of trees from which any resin can be procured is not more than one in a hundred. Mr. Ellis (*Journ. of Pharm.*, vol. ii. p. 20) informs us that the mode of obtaining it is as follows: "Trees are selected upon whose bark the resin is incrustated, which are easily designated by a streak of a dark brown colour on one side of the tree, from near the top to the bottom. These are cut down, and the bark, upon which the resin has hardened, stripped off and thrown into a kettle containing water, with weights placed upon it to prevent its floating. By boiling the water, the resin is melted and rises to the surface, is skimmed off, and thrown into cold water. It is then put into a coarse linen bag and submitted to a second ebullition, treating it as in the former instance, which deprives it of many of its impurities."

The quantity from good-sized trees is from six to ten pounds, the average from four to five. The colour of it as it exudes is nearly white; it hardens immediately, and changes to yellow, brown, and sometimes nearly black. Hemlock resin is in masses, very brittle. It is a resin in combination with a small quantity of volatile oil. It is heavier than water, sp. gr. 1.034. The odour is peculiar, and unlike turpentine. To purify it, it should be melted and strained. From its adhesiveness and stimulating properties, it affords a plaster which is equal to that made with Burgundy Pitch, if not superior. It may be employed for the same purposes.]

5. *Pix liquida and Pix solida.*—Tar and Pitch.

1. *Pix Liquida.*—Vegetable Tar.

(*Bitumen liquidum e ligno igne præparatum, L.*—*Pix liquida, L. E. D.*)

HISTORY.—This is the *πίττα* of Theophrastus,¹ the *πίσσα ὑγρά* (*liquid pitch*), or *πῶρος* of Dioscorides,² and the *pix liquida* of Pliny.³

PREPARATION.—Two kinds of *tar* are known in commerce; namely, *coal tar* and *wood tar*. They are obtained in the destructive distillation—the first of coal, the second of wood.

Of wood tar there are two sorts: one procured in the northern parts of Europe and in America, from the waste of fir timber, and known in commerce as *Stockholm tar*, *Archangel tar*, *American tar*, &c.; the other obtained as a secondary product in the manufacture of pyroligneous acid and gunpowder charcoal. The former is the kind used in medicine. That which is procured from *Pinus sylvestris*, in the northern parts of Europe, is considered to be much superior to American tar.

The process now followed seems to be identical with that practised by the Macedonians, as described by Theophrastus. It is a kind of *distillatio per descensum* of

Fig. 282.



Preparation of Tar.

the roots and other woody parts of old pines. As now carried on in Bothnia, it is thus described by Dr. Clarke:¹ “The situation most favourable to the process is in a forest near to a marsh or bog, because the roots of the fir, from which tar is principally extracted, are always most productive in such places. A conical cavity is then made in the ground (generally in the side of a bank or sloping hill); and the roots of the fir, together with logs and billets of the same, being neatly trussed in a stack of the same conical shape, are let into this cavity. The whole is then covered with turf, to prevent the volatile parts from being dissipated, which, by means of a heavy wooden mallet and wooden stamper, worked separately by two men, is beaten down, and rendered as firm as possible about the wood. The stack of billets is then kindled, and a slow combustion of the fir takes place, without flame, as in working charcoal. During this combustion the tar exudes, and a cast-iron pan being at the bottom of the funnel, with a spout which projects through the side of the bank, barrels are placed beneath this spout to collect the fluid as it comes away. As fast as the barrels are filled, they are bunged, and ready for immediate exportation.”

Wood-tar is also obtained as a secondary product, in the manufacture of acetic acid, by the dry distillation of wood.

¹ *Hist. Plant.* lib. ix. cap. ii. and iii.
² *Hist. Nat.* lib. xxiv. cap. 24, ed. Valp.

³ Lib. i. cap. xciv.

⁴ *Travels in Scandinavia*, part iii. p. 251; see also Duhamel, *Traité des Arbres*.

COMMERCE.—Wood-tar is imported into this country chiefly from the northern parts of Europe (Russia, Sweden, Norway, Denmark, and North Germany)—partly from the United States of America. It usually comes in barrels, each holding 31½ gallons; twelve barrels constituting a *last*. Tar is also produced in this country.

PROPERTIES.—It is a dark brown, viscid, semi-liquid substance, which preserves during a long period its softness. It is soluble in alcohol, ether, and the oils both fixed and volatile. Submitted to distillation, it yields an aqueous acid liquor (*pyroligneous acid*), and a volatile oily matter (*oil of tar*); the residue in the still is *pitch*.

COMPOSITION.—Wood-tar is a very complex substance. It consists principally of *pyretine* (pyrogenous or empyreumatic resin), *pyroliene* (pyrogenous oil), *acetic acid*, and *water*.—Reichenbach has obtained from it *creasote*, *paraffin*, *capion*, *picamar*, *kapnomor*, *pittacal*, and *cedrret*.—*Pyren* and *chrysen* have likewise been found in it.

The tar obtained from coniferous woods contains also *colophony* and *oil of turpentine*.

PHYSIOLOGICAL EFFECTS.—The effects of tar are analogous to those of turpentine, but modified by the presence of acetic acid and the pyrogenous products. Locally it acts as a stimulant; and when applied to chronic skin diseases and indolent ulcers, it frequently induces a salutary change in the action of the capillary and secreting vessels, evinced by the improved quality of the secretions, and the rapid healing of the sores. In such cases, it is termed detergent, digestive, or cicatrisant. Swallowed, it acts as a local irritant and stimulant, becomes absorbed, and stimulates the secreting organs, especially the kidneys, on which it operates as a diuretic. Slight¹ states that a sailor swallowed a considerable quantity of liquid tar, which caused vomiting, great lassitude, and violent pain in bowels and kidneys. The urine was red, and, as well as the other evacuations, had the odour of tar. The head and the pulse were unaffected. The *vapour of tar*, inhaled, acts as a stimulant and irritant to the bronchial membrane, the secretion of which it promotes.

USES.—Tar is rarely employed *internally*. It has, however, been administered in chronic bronchial affections, and in obstinate skin diseases.

The *inhalation of tar vapour* was recommended by Sir Alex. Crichton² in phthisis; but at best it proves only a palliative, and it frequently, perhaps generally, fails to act even thus, and in some cases occasions a temporary increase of cough and irritation.³ In chronic laryngeal and bronchial affections it has more chance of doing good.⁴ Sir A. Crichton's directions for using it in phthisis are as follows: The tar employed should be that used in the cordage of ships; to every pound of which half an ounce of carbonate of potash must be added, in order to neutralize the pyroligneous acid generally found mixed with the tar, the presence of which will necessarily excite coughing. The tar thus prepared is to be placed in a suitable vessel over a lamp, and to be kept slowly boiling in the chamber during the night as well as the day. The vessel, however, ought to be cleansed and replenished every twenty-four hours, otherwise the residuum may be burned and decomposed—a circumstance which will occasion increased cough and oppression on the chest.

Applied *externally*, tar is used in various forms of obstinate skin diseases, especially those which affect the scalp, lepra, &c.

ADMINISTRATION.—Internally, tar is administered either in substance, in the form of pills, made up with wheat flour, or of electuary, with sugar; or in the form of tar water. In substance, it may be taken to the extent of several drachms daily.

1. *AQUA PICIS LIQUIDÆ*; *Tar Water*.—(Tar Oij; Water Cong. j [*wine measure*]. Mix, stirring with a stick for a quarter of an hour; then, as soon as the tar subsides, strain the liquor, and keep it in well-stoppered jars.)—Tar water has the colour of

¹ Wibmer, *Wirk d. Arzneim.* Bd. iv. S. 215.

² *Practical Observations on the Treatment and Cure of several varieties of Pulmonary Consumption and on the Effects of the Vapour of boiling Tar in that Disease*, 1823.

³ Dr. Forbes, Translation of Laennec's *Treatise on Diseases of the Chest*, p. 365.

⁴ Trousseau and Pidoux, *Traité de Thérap.* t. i. p. 459.

Madeira wine, and a sharp empyreumatic taste. It reddens litmus, but does not effervesce on the addition of a solution of carbonate of potash, though its colour becomes deepened. With a solution of bicarbonate of potash a very slight effervescence takes place. By persulphate of iron, tar water is rendered very dark, or even blackish. The volatile oil contained in tar water is partly held in solution by acetic acid, which, as is well known, dissolves creasote. It consists of water holding in solution acetic acid, and pyrogenous oil and resin. Notwithstanding the high eulogies passed on it by Bishop Berkeley,¹ tar water is now rarely employed. It is occasionally administered in chronic catarrhal and nephritic complaints, to the extent of one or two pints daily. As a wash in chronic skin diseases, especially those affecting the scalps of children, I have frequently seen it used, and sometimes with apparent benefit.

2. **UNGUENTUM PICIS LIQUIDÆ**, L. E. D. [U. S.]; *Tar Ointment*.—(Tar, Mutton Suet, of each ℥bj. Melt them together, and press through a linen cloth. The *Edinburgh College* takes of Tar ℥v, and Beeswax ℥ij; melt the wax with a gentle heat, add the tar, and stir the mixture briskly, while it concretes on cooling. The *Dublin College* orders of Tar Oss; Yellow Wax ℥iv.)—Its principal use is as an application to ringworm of the scalp and scalled head, in which it sometimes succeeds, but more frequently fails to cure. It is now and then applied to foul ulcers.

3. **OLEUM PICIS LIQUIDÆ**; *Oleum Pini rubrum*; *Oil of Tar*.—This is obtained by distillation from tar. It is a reddish, limpid fluid, having the odour of tar. It is a mixture of various volatile constituents of tar. By redistillation it may be rendered colourless, and then becomes very similar to oil of turpentine. It is occasionally used as an application to ringworm of the scalp and scalled head. Swallowed in a large dose it has proved fatal.²

2. *Pix nigra*.—Black Pitch.

(Pix, L.; Bitumen aridum e Pice liquida præparata; Pix arida.)

HISTORY.—This is the *πίσσα ξηρά* (*dry pitch*) of Dioscorides,³ which, he says, some call *παλίμπισσα* (*pitch re-boiled*).

PREPARATION.—The residuum in the still after the distillation of wood-tar is *pitch* (*pix nigra*, L.)

PROPERTIES.—At ordinary temperatures it is a black solid, having a brilliant fracture. It softens at 99° F. and melts in boiling water. It dissolves in alcohol, and in solutions of the alkalies and of the alkaline carbonates.

COMPOSITION.—Pitch is composed of *pyrogenous resin* and *colophony*.

PHYSIOLOGICAL EFFECTS.—Made into pills with flour or any farinaceous substance, pitch may be taken to a great extent, not only without injury, but with advantage to the general health. It affords one of the most effectual means of controlling the languid circulation, and the inert and arid condition of the skin.⁴ As a local remedy it possesses great adhesiveness, and when applied to wounds and ulcers acts as a stimulant and digestive.

USES.—Bateman⁵ speaks favourably of the internal use of pitch in *ichthyosis*. It has been employed also in other obstinate skin diseases. But the principal use of pitch is in the form of ointment, as an application to cutaneous affections of the scalp.

ADMINISTRATION.—Dose from grs. x to ʒj, made into pills with flour. The unpleasant pitchy flavour of the pills is materially diminished by keeping them for some time.

UNGUENTUM PICIS, L.; *Unguentum Picis nigri*; *Unguentum Basilicum nigrum* vel *Tetrapharmacum*.—(Black Pitch, Wax, Resin, of each ʒxj; Olive Oil Oj.

¹ *Siris, a Chain of Phil. Reflex. and Inq. concerning Tar Water*, new edit. Lond. 1714.

² *Lancet* for 1832-3, vol. ii. p. 598; also March 8, 1834.

⁴ Bateman, *Synopsis of Cutaneous Diseases*, p. 53, 6th ed.

³ Lib. i. cap. 97.

⁵ *Op. cit.*

Melt them together, and press through a linen cloth.)—Stimulant and digestive; used in the obstinate cutaneous eruptions of the scalp.¹

Sub-order II. CUPRESSEÆ.

Ovules erect; pollen spheroidal.

105. JUNIPERUS COMMUNIS, Linn.—COMMON JUNIPER.

Sex. Syst. Diœcia, Monadelphia.

[Fructus; et Oleum e fructu destillatum, L.—Cacumina; Fructus; Oleum, E.—Cacumina; Baccæ, D.]
[Juniperus. The fruit of Juniperus Communis, U. S.]

HISTORY.—The tree which in our translation of the Bible² is called the *juniper*, is supposed to have been a leguminous plant, either broom or furse (*genista* vel *ulex*).

Juniperus communis is a native of Greece, and must, therefore, have been known to the ancient Greeks. Sibthorp³ thinks that it may perhaps be the ἀρκευθος μύρτα of Dioscorides,⁴ a name which Fraas⁵ considers to have been applied to *Juniperus oxycedrus*. The last-mentioned authority is of opinion that the κέδρος μύρτα of Dioscorides⁶ is our juniper. The fruit mentioned in the Hippocratic writings under the name of ἀρκευθίς, and which was used in some disorders of females, was the produce of a species of *Juniperus*; perhaps of the *J. phœnicia*, which is very common in Greece and the islands of the Archipelago, and whose fruit is yellowish, but has the size, form, and powers of that of the common juniper.

BOTANY. Gen. Char.—*Diœcious*, rarely *monœcious*. **MALES:** *Catkins* ovate; the scales verticillate, peltato-pedicellate. *Anthers* 4 to 8, unilocular. **FEMALES:** *Catkins* globose; the 3 concave scales united. *Stigma* gaping. *Galbulus* composed of the united and fleshy scales, and containing 3 triquetrous osseous seeds.

Sp. Char.—*Leaves* 3 in each whorl, spreading, linear-subulate, keeled, mucronate, longer than the galbulus.

Fig. 283.



Female flower and fruit of *Juniperus communis*.

- a. Female amentum (magnified).
- b. Ditto at a later stage of evolution (magnified).
- c. Two ovaries; the third having been removed to expose the ovules.
- d. Fruit approaching maturity.
- e. Ripe galbulus, seen from the vertex.
- f. Ditto, seen from the base.

A bushy *shrub*. *Leaves* evergreen, numerous, with a broad, flat, shallow channel above, the keel beneath with a slender furrow, pungent, glaucous on the upper side, dark green beneath. *Flowers* axillary, sessile, small; the *males* discharging a copious cloud of yellow pollen: *females* green, on scaly stalks. *Fruit* commonly called a *berry*, but is in reality that kind of cone called by botanists a *galbulus*, which has fleshy coalescent carpella, whose heads are much enlarged. It requires two seasons to arrive at maturity. The galbulus is black tinged with blue, and is scarcely more than half the length of the leaves.

Loudon⁷ mentions no less than seven varieties; but some of these are probably distinct species.

Juniperus nana (Smith), Dwarf Alpine Juniper, has a procumbent stem; imbricate, incurved, linear-lanceolate leaves; and fruit nearly as long as the leaves.—Indigenous On mountains.

¹ Vide *Unguentum Picis liquidæ*.

² *Prod. Fl. Græcæ*.

³ *Synopsis Plant. Fl. Classicæ*, p. 259, 1845.

⁴ *Arboretum*, vol. iv. p. 2489.

⁵ *Job*, xxx. 4; *1 Kings*, xix. 4.

⁶ *Lib i. cap.* 103.

⁷ *Ibid.* 105.

Hab.—North of Europe. Indigenous, growing on hills and healthy downs, especially where the soil is chalky. It flowers in May.

DESCRIPTION.—In this country the *fruit* and *tops*, and on the continent, the *wood*, are officinal.

Juniper berries (*baccæ juniperi*), as the dried fruit of the shops is commonly termed, are about the size of a pea, of a blackish-purple colour, covered by a glaucous bloom. They are marked superiorly with a triradiate groove, indicating the adhesion of the succulent carpella; inferiorly with the bracteal scales, which assume a stellate-form (see Fig. 283, *c* and *f*). They contain three seeds. Their taste is sweetish, with a terebinthinate flavour; their odour is agreeable and balsamic.

Juniper tops (*cacumina seu summitates juniperi*) have a bitter terebinthinate flavour and a balsamic odour.

Juniper wood (*lignum juniperi*) is obtained either from the stem or root; it evolves a balsamic odour in burning, and, by distillation with water, yields volatile oil. On old stems there is sometimes found a resinous substance (*resina juniperi*; *sandaraca germanica*).

SANDARACH OR JUNIPER RESIN.—The resin called *sandarach* (*sandaraca*), or *gum juniper* (*gummi juniperi*), is imported from Mogadore. It is the produce of *Callitris quadrivalvis*, Vent. (*Thuja articulata*, Desf.). Though sold by chemists and apothecaries, it is not employed in medicine. It is used in the manufacture of varnishes. Its powder is *pounce*.

COMMERCE.—Juniper berries are imported in bags and barrels from Rotterdam, Hamburgh, Leghorn, Trieste, and other European ports. In 1838, duty was paid on 5896 cwt.

COMPOSITION.—Juniper berries were analyzed in 1822 by Trommsdorff,¹ and in 1831 by Nicolet.² Trommsdorff obtained *volatile oil* 1.0, *wax* 4.0, *resin* 10.0, *a peculiar species of sugar with acetate and malate of lime* 33.8, *gum with salts of potash and lime* 7.0, *lignin* 35.0, *water* 12.9 (=103.7, excess 3.7).

1. **OIL OF JUNIPER** (see below).

2. **RESIN.**—Is green, according to Trommsdorff. Nicolet obtained it in the crystallized state, and found it to consist of $C^5H^2O^1$.

3. **WAX.**—Is brittle. Consists, according to Nicolet, of $C^{13}H^{24}O^4$.

4. **SUGAR.**—Is crystallizable, and analogous to grape sugar, according to Trommsdorff. But Nicolet describes it as being like molasses.

PHYSIOLOGICAL EFFECTS.—Juniper berries and tops are analogous in their operation to the terebinthinate substances. Three ounces of the berries act on the larger herbivorous animals as a diuretic.³ On man, also, these fruits operate on the urinary organs, promoting the secretion of urine, to which they communicate a violet odour.⁴ In large doses they occasion irritation of the bladder and heat in the urinary passages. Piso⁵ says their continued use causes bloody urine. They promote sweat, relieve flatulency, and provoke the catamenia. Their activity is principally dependent on the volatile oil which they contain, and which, according to Mr. Alexander's experiments,⁶ is, in doses of four drops, the most powerful of all the diuretics.⁷

USES.—Juniper berries or oil are but little used in medicine. They may be employed, either alone or as adjuncts to other diuretic medicines, in *dropsical disorders* indicating the employment of renal stimuli. Van Swieten⁸ speaks favourably of their use in mild cases of ascites and anasarca. In some affections of the *urino-genital apparatus* juniper may be employed with advantage. Thus in mucous discharges (as gonorrhœa, gleet, leucorrhœa, and cystirrhœa) it may be used under the same regulations that govern the employment of copaiba and the terebinthines. Hecker⁹ praised it in the first stage of gonorrhœa.

Juniper has been advised in some other diseases, but I do not think it necessary to enumerate them.¹⁰

¹ Gmelin's *Handb. d. Chem.* ii. 1330.

² Moiroud, *Pharm. Vétér.*

³ Murray, *App. Med.*

⁴ See his *Table*, at p. 251.

⁵ *Anweisung d. vener. Krankh.* quoted by Voigtels, *Arzneim.* Bd. ii. Abt. 2, S. 510.

⁶ Consult on this subject, Vogt, *Lehrb. d. Pharmacodyn.*; Richter, *Arzneimittel.*; and Sundelin, *Spec.*

Heilmittel.

⁷ Thomson's *Organic Chemistry*, p. 899.

⁸ Cargillus, in Ray, *Hist. Plant.* t. ii. p. 1412.

⁹ *Experimental Essays*, p. 149, 1768.

¹⁰ *Commentaries*, English edit. 12mo. vol. xii. p. 431.

ADMINISTRATION.—The dose of the *berries* is one or two drachms, triturated with sugar. The *infusion* (prepared with an ounce of the berries and a pint of boiling water) is a more convenient mode of exhibition; the dose is fʒiv every four hours.

1. OLEUM JUNIPERI, E. D. [U. S.]; *Oleum Juniperi (Anglicum), L.*; *Oil of Juniper; English Oil of Juniper.*—Is obtained by submitting the fruit, tops, or wood, to distillation with water. The full-grown green fruit yields more than the ripe fruit, for, in the act of ripening, a portion of the oil becomes converted into resin. It is limpid, transparent, nearly colourless, and lighter than water, and causes the left-handed rotation of polarized light—in this respect agreeing with French oil of turpentine. It has the odour of the fruit and an aromatic balsamic taste. It dissolves with difficulty in alcohol. According to Blanchet, it consists of two isomeric oils, carburets of hydrogen, $C^{20}H^{16}$: one colourless, and more volatile: a second coloured, and less volatile. Both, when agitated with a solution of salt, form crystalline hydrates. The more volatile oil almost entirely constitutes the oil obtained from the ripe fruit. It is soluble in alcohol and in hydrochloric acid, with which it forms a liquid artificial camphor. Its density is 0.839.

The oil is, perhaps, the best form for exhibiting juniper. The dose is two to six drops, either in the form of pill or diffused through water by the aid of sugar and mucilage.

OLEUM EMPYREUMATICUM JUNIPERI.—By the dry distillation of the wood of *Juniperus Oxycedrus* there is obtained, in France, a tarry oil called *huile de cade (oleum cadinum)*. It is a brownish, inflammable liquid, having a strong empyreumatic and resinous odour, and an acrid caustic taste. It is employed in veterinary medicine; to cure ulcers in horses, and, formerly, to cure the itch in sheep. Oil of tar, which is often substituted for it, is considered to be inferior. It has also been used in the human subject, both externally and internally; in obstinate skin diseases, worms, toothache, &c. Dose, a few drops.

2. SPIRITUS JUNIPERI COMPOSITUS, L. E.; *Compound Spirit of Juniper.*—(Oil of Juniper fʒiss; Oil of Caraway, Oil of Fennel, of each ℥xij [℥x, U. S.]; Proof Spirit, *Cong. j.* Dissolve, *L.*—Juniper Berries, bruised, ℔bj; Fennel bruised, and Caraway bruised, of each ʒiss; Proof Spirit Oviij; Water Oij. Macerate the fruits in the spirit for two days, add the water, and distil off seven pints, *E.*)—This preparation, when sweetened, may be regarded as an officinal substitute for *genuine Hollands* and *English gin*, both of which compounds are flavoured with juniper. It is used as an adjunct to diuretic mixtures. The dose is fʒij to fʒiv.

106. JUNIPERUS SABINA, Linn.—COMMON SAVIN.

Sex. Syst. Diœcia, Monadelphica.

(Cacumen recens et exsiccatum. Oleum e cacumine destillatum, *L.*—Tops, *E.*)
[Sabina, *U. S.*]

HISTORY.—This is the *βράβυ* of Dioscorides,¹ the *sabina* of Pliny.² Each of these writers notices both the cypress-leaved and the tamarisk-leaved varieties of savin.

BOTANY. Gen. Char.—Vide *Juniperus communis*.

Sp. Char.—*Leaves* ovate, convex, densely imbricated, erect, decurrent, opposite; the oppositions pyxidate (*Bot. Gall.*).

A small bushy shrub. Branches closely invested by the very small glandular leaves. *Galbulus* round, purple, somewhat smaller than that of *Juniperus communis*.

London³ mentions five varieties. Of these the most interesting are the two following:—

α. J. S. cupressifolia, Aiton.—The Cypress-leaved Savin. La Sabine mâle. Leaves acute, more spreading, three lines long.

β J. S. tamariscifolia, Aiton.—The Tamarisk-leaved or berry-bearing Savin. La Sabine femelle. Leaves shorter, almost appressed and obtuse.

¹ Lib. i. cap. 104.

² *Arboretum*, vol. iv. p. 2499.

³ *Hist. Nat. lib. xxiv. cap. 61, ed. Valsp.*

Another variety, *J. S. foliis variegatis*, has variegated leaves. A fourth, *J. S. prostrata*, is a low trailing plant. The fifth, *J. S. alpina*, is procumbent, and more slender than the fourth.

Hab.—Midland and southern parts of Europe, Asiatic Russia. Cultivated in gardens in this country. Flowers in April.

JUNIPERUS VIRGINIANA, Linn., the *Red Cedar* (the wood of which is used for black-lead pencils) is used in the United States as a substitute for savin.

DESCRIPTION.—The official parts of the plant are the *tops* (*cacumina, summitates*), which consist of the young branches with their attached leaves. They have, in the fresh state (*cacumina recentia*), a strong, peculiar, heavy odour, especially when rubbed; and a nauseous, resinous, bitter taste. The dried tops (*cacumina exsiccata*) are yellowish green, and less odorous than the fresh ones.

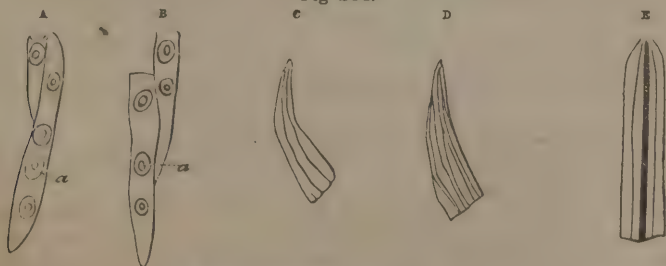
COMPOSITION.—Some experiments on the composition of savin were made by Berlisky.¹ In 1837, an analysis of this plant was made by a young chemist of the name of Gardes.² The constituents are *volatile oil, resin, gallic acid, chlorophyll, extractive, lignin, and calcareous salts*.

OIL OF SAVIN (see p. 311).

CHEMICAL CHARACTERISTICS.—An aqueous infusion of savin is yellowish, has the odour and bitter taste of the herb, and forms a soluble green compound (*gallate? of iron*) on the addition of sesquichloride of iron, but is unchanged by a solution of gelatin. Oxalate of ammonia causes, in the infusion, a white precipitate (*oxalate of lime*). Alcohol acquires a green colour when digested with the tops: on the addition of water to the alcoholic tincture some *resin* is separated. By distillation with water, both the fresh and dried tops (but especially the first) yield *volatile oil*.

DETECTION.—Savin is sometimes employed for criminal purposes, and, therefore, occasionally becomes the subject of medico-legal inquiries. Powdered savin in the stomach and bowels might, on account of its green colour, be mistaken for bile; but, when mixed with distilled water, it entirely subsides; and, provided no bile be intermixed, the supernatant liquor will be devoid of a green colour. The powder, when dry, may be detected to be that of savin by the peculiar odour of this herb. The odorous principle (volatile oil) might, if the quantity of powder be sufficient, be separated by submitting this to distillation with water. Moreover, savin powder yields a green colour to alcohol, and its aqueous infusion strikes a green colour with the tincture of the sesquichloride of iron. If the powder be coarse, the microscope may give us important aid in detecting savin. A careful examination of the woody fibres will detect their circular pores (Fig. 284, A B), characteristic of the Gymnosperms (see *ante*, p. 282); and by the shape of the apex of the leaves (when these can be obtained), savin (Fig. 284, C D) may be detected from another poisonous gymnospermous plant (Fig. 284, E), namely, the Yew (*Taxus baccata*).³

Fig. 284.



Juniperus Sabina.

Taxus baccata.

A B. Woody fibres (magnified) of Savin; showing *a a*, the pores.

C D. Magnified extremity of the leaf of Savin, showing the subulate linear leaves.

E. Magnified extremity of the leaf of Yew (*Taxus baccata*), showing the linear acute leaves.

¹ Trommsdorff's *Journ.* viii. 1, 94.

² *Journ. de Chim. Méd.* t. iii. p. 331, 2de Ser.

³ See an interesting report of a case of poisoning by savin, in which the above characters were successfully made use of to detect the poison, by Dr. A. Taylor and Mr. Charles Johnson, in the *Lond. Med. Gaz.* for Aug. 8, 1815, p. 646.

PHYSIOLOGICAL EFFECTS. *α. On Animals.*—Savin acts on animals as an acrid poison. Orfila¹ applied two drachms of the powder to an incised wound in the leg of a dog; inflammation and infiltration of the limb took place, and death occurred in about thirty-six hours. Four drachms introduced into the stomach of a dog, and the œsophagus tied, caused death in thirteen hours; the stomach was bright red, and the rectum a little inflamed. Orfila infers that its effects depend principally on its absorption and its action on the nervous system, the rectum, and the stomach. A drachm of *oil of savin* was given by Hillefield² to a cat. It caused a flow of saliva, anxiety, frequent discharge of urine, dulness, trembling, and, in an hour and a quarter, bloody urine. The animal having been strangled, the bladder was found contracted, with some coagulated blood contained in its cavity.

β. On Man.—Oil of savin, the active principle of the herb, is a powerful local irritant. When applied to the skin, it acts as a rubefacient and vesicant. On wounds and ulcers its operation is that of an acrid (not chemical) caustic. Swallowed in large doses, it occasions vomiting, purging, and other symptoms of gastro-intestinal inflammation. In its operation on the system generally, it is powerfully stimulant. "Savin," says Sundelin,³ "operates not merely as irritants generally do, as a stimulant to the arterial system, but it also eminently heightens the vitality of the venous system, the circulation in which it quickens. It next powerfully stimulates the absorbing vessels and glands, the serous, the fibrous, and the mucous membranes, and the skin. It operates as a specific excitant and irritant on the kidneys, and yet more obviously on the uterus. The increased secretion of bile and the augmented volume of the liver, both of which conditions have sometimes been observed after the copious and long-continued use of savin, appear to be connected with its action on the venous system." Mohrenheim⁴ mentions the case of a woman, 30 years of age, who swallowed an infusion of savin to occasion abortion. Violent and incessant vomiting was induced. After some days she experienced excruciating pains, which were followed by abortion, dreadful hemorrhage from the uterus, and death. On examination, the gall-bladder was found ruptured, the bile effused in the abdomen, and the intestines inflamed. The popular notion of its tendency to cause abortion leads, on many occasions, to the improper use of savin; and the above is not a solitary instance of the fatal consequences thereof. A fatal case of its use as an emmenagogue is recorded by Dr. Dewees.⁵ That it may frequently fail to provoke premature labour is shown by the case, related by Fodéré,⁶ of a woman who, in order to produce abortion, took every morning, for twenty days, one hundred drops of this oil, and yet went her full time and brought forth a living child. It ought to be well known that, in those cases in which it may succeed in causing miscarriage, it can only do so at the risk of the woman's life. Vogt⁷ says that it has a tendency to induce an apoplectic state in the fetus. The emmenagogue power of savin is fully established. Perhaps the observations of Home⁸ are the most satisfactory of any on this subject, confirmed as they are by the reports of many other accurate observers.

USES.—Savin is not much used internally; but, in cases of amenorrhœa and chlorosis depending on or accompanied by a torpid condition or deficient action of the uterine vessels, it may be given as a powerful uterine stimulant. In such cases it proves a most efficient remedy. According to my own observation, it is the most certain and powerful emmenagogue of the whole materia medica. My experience of it, therefore, confirms the statements of Home.⁹ Though I have employed it in numerous cases, I never saw any ill effects result from its administration. Of course its use is contraindicated where irritation of the uterus, or indeed of any of the pelvic viscera, exists.

¹ *Toxicol. Gén.*

² *Heilmittellehre*, Bd. ii. S. 180, Auf. 3te.

³ *Compend. Syst. of Midwifery*, pp. 133-4.

⁴ *Pharmakodyn.*

⁵ *Wibmer, Wirk. d. Arzneim. u. Gifte*, Bd. iii. II. 1, p. 191.

⁶ *Murray, App. Med.* vol. i. p. 59.

⁷ *Med. Leg.*

⁸ *Clinical Experiments*, p. 419.

⁹ *Ibid.*

In chronic rheumatism, with a languid circulation in the extreme vessels, Chapman¹ speaks in very high terms of it. It has been used as an anthelmintic.

As a topical agent, savin is frequently employed, mostly in the form of the cerate, to make *perpetual blisters*. Equal parts of savin and verdigris, in powder, form one of the most efficacious applications for the removal of venereal warts. The powder, an infusion, or the expressed juice of the plant, is occasionally applied to warts, to old and indolent ulcers, and in cases of psora and tinea.

ADMINISTRATION.—By drying, savin loses part of its volatile oil, and hence the powder is not the best preparation of it. It is, however, sometimes given in doses of from five to fifteen grains. A *decoction* and *extract* are also objectionable preparations, on account of the heat employed in making them. An *infusion* may be prepared by digesting ʒj of the fresh herb in fʒviij of boiling water: the dose is one or two tablespoonfuls. The *oil* is by far the most convenient and certain preparation of savin, and is the only one which I employ. A *conserve* of the fresh leaves is sometimes used.

1. OLEUM SABINÆ, E. D. [U. S.]; *Oil of Savin*.—This is obtained by submitting the fresh tops to distillation with water. It is a limpid, almost colourless liquid, having the unpleasant odour of the plant, and a bitter acrid taste. Its sp. gr. is 0.915. Its composition is analogous to that of oil of turpentine, being C²⁰H¹⁶. It agrees with English oil of turpentine in its power of effecting the right-handed rotation of plane polarized light. Winckler² states that he dissolved one ounce of savin oil in the same quantity of concentrated sulphuric acid, and then distilled it from milk of lime (to remove the sulphurous acid), and obtained two drachms of an oil which was undistinguished from the volatile oil of thyme. The dose of oil of savin, as an emmenagogue, is from two to six drops, diffused in a mucilaginous or oleaginous mixture.

2. UNGUENTUM SABINÆ, L. D.; *Savin Ointment*, E. [U. S.]; *Ceratum Sabinæ*.—(Fresh Savin, bruised, ℥ss; White Wax ʒiij; Lard ℥j. Mix the savin in the lard and wax melted together, then press through a linen cloth. The *Edinburgh College* orders of Fresh Savin *two parts*; Beeswax *one part*; Axunge *four parts*. Melt the wax and axunge together, add the savin and boil them together till the leaves are friable; then strain. The *Dublin College* orders Savin Tops, dried and in fine powder, ʒj; Ointment of White Wax ʒviij. Mix the powder intimately with the ointment by trituration. [The *U. S. Pharm.* directs Savin, in powder, ʒij; Resin Cerate ℥j. Mix the savin with the cerate previously melted.])—The boiling is considered objectionable on account of the loss of a portion of the oil. The colour of this cerate should be fine green, and its odour that of the plant; the former property depends on chlorophylle, and the latter on the oil of savin. Savin cerate is used as a dressing to blistered surfaces, to produce what is termed a *perpetual blister*. It is preferred to the ceratum cantharidis as being less acrid, and not liable to cause strangury. It is sometimes applied to seton tapes, to increase the discharge from setons.

ANTIDOTES.—In a case of poisoning by savin herb or its oil, the first indication is to remove the poison from the stomach and bowels. Opiates and demulcent drinks should then be given. The warm bath may be advantageously employed. Bloodletting should be resorted to if the inflammatory symptoms indicate, and the condition of the system permit it.

ORDER XXIII. TAXACEÆ, Lindl.—TAXADS.

TAXINEÆ, Endl.

CHARACTERS.—Naked seeded exogens, with repeatedly branched, continuous stems, simple leaves often fork-veined, solitary female flowers, 2-celled anthers opening longitudinally, membrane

¹ *Elem. of Therap.*

² *Buchner's Repertorium*, 2ter Reihe, Bd. xlii. S. 330, 1846.

next the nucleus of the *ovule* inclosed, *seed* usually supported or surrounded by a succulent imperfect cap-shaped pericarp, *embryo* straightened, dicotyledonous, and *albumen* fleshy.

PROPERTIES.—The *Taxaceæ* agree with the *Pinaceæ* in the resinous quality of their juices, but abound more in bitter astringent, and some of them in narcotico-acrid principles.

107. *Taxus baccata*, Linn.—Common Yew.

Sex. Syst. Diœcia, Monadelphia.

(*Folia et semina.*)

Σμύδαξ, by some called Σύμαλος, by the Romans termed τάζος; Dioscorides, lib. iv. cap. 80.—*Taxus*, Pliny, lib. xvi. cap. 20 et 33; and lib. xxiv. cap. 72.—A tree often attaining a considerable bulk. Leaves scattered, nearly sessile, 2-ranked, crowded, linear, acute, entire, very slightly revolute, about 1 inch long, dark green, smooth and shining above, paler with a prominent midrib beneath, terminating in a small harmless point. Flowers axillary sessile. Fruit drooping, consisting of a succulent, sweet, internally glutinous, scarlet cup, inclosing an oval, brown, nuciform seed, unconnected with the fleshy part.—In 1828, Peretti¹ analyzed yew (the *leaves*?), and obtained a bitter volatile oil, a bitter non-crystallizable substance, a yellow colouring matter, resin, tannin, gallic acid, chlorophyll, mucilage, sugar, and malate of lime. In 1818, Chevallier and Lassaigne² examined the pulpy cup of the *fruit*, and found in it a non-crystallizable fermentable sugar, gum, malic and phosphoric acids, and a carmine-red fatty matter. In 1843, Martin³ analyzed the seeds, and obtained from them a volatile oil having a terebinthinate odour, fixed oil, a green very bitter resin, sugar, albumen (in small quantity), sulphate of lime, and vegetable fibre.

The poisonous properties of yew were known to the ancient Greeks and Romans, and have been fully established by modern experience, although some few writers have expressed doubts concerning them. Percival⁴ states that three children were poisoned by the fresh leaves. Dr. Mollan⁵ has mentioned the case of a lunatic who died in 14 hours after taking yew-leaves: the symptoms were giddiness, sudden prostration of strength, vomiting, coldness of the surface, spasms, and irregular action of the heart. Mr. Hurt⁶ has reported an interesting case of a child, three years and a half old, who died in less than four hours after eating the fruit: the symptoms were vomiting, convulsions, purple lips, and dilated pupil. Considered both in a toxicological and therapeutical point of view, the yew appears to hold an intermediate position between *savin* and *foxglove*. To *savin* it is allied by its botanical affinities and chemical composition, but also by its acrid, evacuant, diuretic, and emmenagogue properties. But, on the other hand, its relation to the neurotics, especially to sedatives (see vol. i., p. 258), is marked by the giddiness, irregular and depressed action of the heart, convulsions, and insensibility which it produces. It is said that, when used for medicinal purposes, it is unlike *digitalis*, in not being apt to accumulate in the system. As a poison it belongs to the class of *acro-narcotics*; as a medicine it is used as a sedative, antispasmodic, emmenagogue, lithic, and resolvent. As a sedative it has been proposed by Rempinelli and Martin to be used as a substitute for, and under the same indications as, *digitalis*. As an emmenagogue it has been given in cases similar to those for which *savin* is sometimes administered. Dr. A. Taylor⁷ says that “infusion of yew-leaves, which is popularly called yew-tree tea, is sometimes used for the purpose of procuring abortion by ignorant midwives.” As a lithic it has been employed in calculous complaints; as an antispasmodic in epilepsy and convulsions; as a resolvent in hepatic and gouty complaints. In pulmonary and vesical catarrh it has likewise been used. The *powder* of the leaves or seeds is given in doses of from half a grain to two or three grains. The *extract of the leaves* (*extractum tazi*, Cod. Hamb.), prepared by evaporating the expressed juice of the leaves, is administered in doses of one or two grains, and gradually increased. The *alcoholic and ethereal extract* of the seeds is employed in doses of from $\frac{1}{6}$ th or $\frac{1}{3}$ d of a grain. In cases of poisoning by yew, the first indication is to expel the poison from the stomach by the means already pointed out (see vol. i. p. 201). The sedative and narcotic effects are to be counteracted by stimulants such as ammonia (see the treatment for poisoning by foxglove).

Sub-class II. *Angiospermæ*.—*Angiosperms*.

EXOGENS, Lindl.

CHARACTERS—*Ovules* inclosed in an ovary, and fertilized by the application of the pollen to the stigma.

¹ *Journ de Pharm.* t. xiv. p. 537, 1828.

² *Ibid.* t. iv. p. 568, 1818.

³ *Jahresbericht über d. Fortschritte d. Pharm. in Jahre 1843*, S. 18.

⁴ *Essays, Med. Phil. and Exper.* vol. iii. p. 257.

⁵ *Dublin Hospital Gazette*, May 15, 1845, p. 109.

⁶ *Lancet*, Dec. 10, 1836.

⁷ *On Poisons*, p. 790.

In accordance with the classification followed by De Candolle, the natural orders of this subclass will be arranged in the four following subdivisions: 1st, *Monochlamydeæ*; 2dly, *Corollifloræ*; 3dly, *Calycifloræ*; and 4thly, *Thalamifloræ*.

SUBDIVISION I. MONOCHLAMYDEÆ, *De Cand.*APETALÆ, *Endlicher.*

Flowers frequently unisexual. Perianth absent, rudimentary or simple, calycine or coloured, free or connate with the ovary.

ORDER XXIV. LIQUIDAMBARACEÆ, *Richard.*—
LIQUIDAMBAR.BALSAMIFLUE, *Blume, Endl.*—ALTINGIACEÆ et olim BALSAMACEÆ, *Lindley.*

CHARACTERS.—Tall trees, with amentaceous unisexual flowers; a 2 celled, 2-lobed, many-seeded capsule; and winged seeds, with the embryo inverted in fleshy albumen.

PROPERTIES.—Balsamic, fragrant.

108. Liquidambar, *Linn.*ALTINGIA, *Noronha.*

As this is the only genus of the order, its characters are necessarily those of the latter. It consists of a very small number of species, of which none probably are officinal. But, as their balsamic products have been confounded with storax and balsam of Peru (two officinal substances), a short notice of them is requisite.

1. *L. styraciflua*, *Linn*; *Sweet Gum*; *White Gum*.—A native of the United States and Mexico, attaining, in the southern districts, an immense size. In Louisiana and Mexico there is obtained, by making incisions into the stem, a fluid balsamic juice called *liquidambar* or *copalm balsam*. In this fluid state it constitutes the *liquid liquidambar*, or oil of *liquidambar* of Guibourt. It is transparent, amber-yellow, has the consistence of a thick oil, a balsamic odour, and an aromatic, acrid, bitter taste. By time it concretes, and becomes darker coloured. The soft solid called by Guibourt *soft* or *white liquidambar*, is perhaps a mixture of the opake deposit of the fluid balsam, and of the latter rendered concrete by keeping. It is a soft, almost opake solid, very similar in appearance to concrete turpentine. Its odour is similar to, though weaker than, the liquid balsam. Its taste is balsamic and sweetish. Bonastre¹ analyzed a very fluid sample, recently received from America, and found it to consist of—volatile oil, 7.0, semi-concrete matter, 11.1; benzoic acid, 1.0; crystalline matter soluble in water and alcohol, 5.3; yellow colouring matter, 2.05; oleo-resin, 49.0; styracin, 24.0; loss, 0.55. The volatile oil consists, according to Henry, of C¹⁰H¹⁷. Styracin is a fusible, crystalline substance, soluble in boiling alcohol, and composed, according to Henry, of C¹¹H²⁰O². The proportion of benzoic [cinnamic?] acid is increased by time. Mr. Hodgson² obtained from a sample which he examined 4.2 per cent.

Liquidambar has been confounded with both *white balsam of Peru* and *liquid storax*. The liquidambar which I have received from M. Guibourt is quite different from a genuine sample of the *white balsam of Peru* received by me from Guatemala, and it is equally different from the liquid storax of the shops. And Dr. Wood³ observes that some of the genuine juice of *liquidambar styraciflua* brought from New Orleans, which he examined, had an odour entirely distinct from that of liquid storax.

A thick, dark-coloured, opake, impure substance is obtained from the young branches of this species by boiling them in water and skimming off the fluid balsam which rises to the surface. This also has been confounded with liquid storax, but none of it comes to this country.

The effects and uses of liquidambar are similar to those of storax and other balsamic substances. The dose of it is from ten to twenty grains.

2. *L. ALTINGIA*, *Blume*; *Altingia excelsa*, *Noronha*.—A native of Java, where it is called *Rusamalla* (*Rasamalla* or *Rosa-mallas*, *Auct.*) It yields a fragrant balsam, which by some writers has been regarded as the liquid storax of the shops. But the latter substance comes to England by way of Trieste, and, according to Landerer,⁴ is the produce of *Styrax officinale*, and as such I shall describe it hereafter (see *Styrax officinale*).⁵ Petiver says that the *Rosa-mallas* grows in Cobross, an island at the upper end of the Red Sea, near Cadess, which is three days³

¹ Journ. de Pharm. t. xvii. p. 338, 1831.

² Journal of the Philadelphia College of Pharmacy, vi. 190.

³ Pharmaceutisches Central-Blatt für 1840, p. 11.

⁴ United States Dispensatory.

⁵ Phil. Trans. vol. xxvi. p. 44.

journey from Suez. Its bark is removed annually, and boiled in salt water until it comes to a consistence like birdlime; it is then separated, put in barrels (each holding 420 lbs.), and sent to Mocha, by way of Judda. The Arabs and Turks call it *Cotter Mija*.

Dr. Marquart¹ analyzed some of the genuine resin of *L. Altingia*, and, by distillation with carbonate of soda, obtained a volatile oil resembling styrol, and a substance resembling styracin, but which had a different composition.

3. *L. ORIENTALE*, Miller; *L. imberbe*, Aiton; *Platanus orientalis*, Poeock.—This tree grows in Cyprus, where it is called *Xylon Effendi* (the wood of our Lord). By incisions made in the bark, it yields a kind of white turpentine, and a very fragrant oil. Dr. Lindley thinks it is probable that the liquid storax of the shops is collected from this tree; but I do not agree with him in this opinion.

ORDER XXV. SALICACEÆ, Lindl.—WILLOWWORTS.

SALICINÆ, Richard.

CHARACTERS.—*Flowers* unisexual, amentaceous. *Stamens* distinct or monadelphous; *anthers* 2-celled. *Ovary* superior, 1-celled; *ovules* numerous, erect, at the base of the cell, or adhering to the lower part of the sides; *style* 1 or 0, *stigmas* 2 or 4. *Fruit* coriaceous, 1-celled, 2 valved, many-seeded. *Seeds* either adhering to the lower part of the axis of each valve, or to the base of the cell; comose; *albumen* 0; *embryo* erect; *radicle* inferior.—*Trees* or *shrubs*. *Leaves* alternate, simple, with deliquescent primary veins, and frequently with glands; *stipules* deciduous or persistent (Lindley).

PROPERTIES.—The barks of the species of this order are astringent and tonic; the astringency being due to tannic acid, the tonic property to salicine or some other bitter principle. An oleo-resinous or balsamic substance, of a stimulant nature, is secreted by the buds of some of the species.

109. SALIX, Linn.—WILLOW.

Sex. Syst. Diœcia, Diandria.

(Cortex e speciebus salicis diversis; cortex salicis, offic.)

HISTORY.—Dioscorides² speaks of the astringent qualities of the *ιρία*, or *wilow* (*Salix alba*?), which was employed in medicine by the ancients. For a long series of years it fell into disuse, but was again brought into notice in 1763, by the Rev. Mr. Stone,³ who published a paper on the efficacy of the bark of *Salix alba*, as a remedy for agues. The broad-leaved willow bark (*Salix Caprea*) was subsequently introduced into practice by Mr. James,⁴ whose observations on its efficacy were afterwards confirmed by Mr. White⁵ and Mr. G. Wilkinson.⁶

BOTANY. *Gen. Char.*—*Flowers* diœcious, or rarely monœcious, amentaceous; *scales* imbricated; a *gland* surrounding the stamens or ovary. **MALES:** *Stamens* 2 to 5, usually 2, sometimes the 2 united into 1, and then the anther is 4-celled. **FEMALES:** *Seeds* comose; the *radicle* inferior (*Bot. Gall.*).

Species.—Sir J. E. Smith⁷ mentions sixty-four indigenous species of *Salix*; but pharmacological and botanical writers are not agreed as to which species possesses the most medicinal power. The best practical rule to follow is this: Select those whose barks possess great bitterness, combined with astringency. The following are those which are in the greatest repute:—

1. *SALIX RUSSELLIANA*, Smith; the *Bedford Willow*.—*Leaves* lanceolate, tapering at each end, serrated throughout, very smooth. *Footstalks* glandular or leafy. *Germen* tapering, stalked, longer than the scales. *Style* as long as the stigmas (Smith).—A *tree*. In marshy woods, wet meadows, &c., in various parts of Britain. Flowers in April and May. Its bark abounds in tannic acid. On account of its astringency, Sir J. E. Smith regards it as the most valuable officinal

¹ *Jahrb. für prakt. Pharmacie*, Bd. v. p. 486 (quoted by Dierbach, in the *Ergänzungsheft* to Geiger's *Handb. d. Pharm.* 2te Aufl 1843).

² *Lib. i. cap. 136.*

³ *Observations on a particular Species of Willow*, 1792.

⁴ *Observations and experiments on the Broad-leaved Willow Bark*, 8vo, Bath, 1798.

⁵ *Experiments and Observ. on the Cortex Salicis Latifolia*, 8vo Newcastle-upon-Tyne [1803].

⁶ *Engl. Flora*, iv.

⁷ *Phil. Trans.* vol. liii. p. 155.

species; and he observes, that if it has occasionally disappointed medical practitioners, they probably chanced in such cases to give the *S. fragilis*.

2. *SALIX ALBA*, Linn.; *the Common White Willow*.—Leaves elliptic-lanceolate, pointed, serrated, silky on both sides; the lowest serratures glandular. Stamens hairy. Germen smooth, almost sessile. Stigmas deeply cloven. Scales rounded (Smith).—A tall tree. River-sides, moist woods, &c., in various parts of Britain. Flowers in May. Its bark, called *cortex salignum*, or *cortex anglicanum* of some writers, is astringent, but less so than that of the preceding species.

3. *SALIX CAPREA*, Linn.; *Salix latifolia rotunda*, Bauhin; *Great Round-leaved Willow*.—Stem erect. Leaves roundish-ovate, pointed, serrated, waved; pale and downy beneath. Stipules somewhat crescent-shaped. Catkins oval. Germen stalked, ovate, silky. Stigmas nearly sessile, undivided. Capsules swelling (Smith).—A tree. Indigenous, very common; growing in woods and hedges. Flowers in April. Its bark is the *broad-leaved willow bark* (*cortex salicis latifoliae*) recommended by James, White, and Wilkinson (see *ante*, p. 314).

4. *SALIX FRAGILIS*, Linn.; *the Crack Willow*.—Leaves ovate-lanceolate, pointed, serrated throughout, very smooth. Footstalks glandular. Germen ovate, abrupt, nearly sessile, smooth. Scales oblong, about equal to the stamens and pistils. Stigmas cloven, longer than the style (Smith).—A tree. Indigenous; about the banks of rivers. Flowers in April and May.

5. *SALIX PENTANDRA*, Linn.; *Sweet Bay-Leaved Willow*.—This species is official in the Prussian Pharmacopœia, and is preferred by Nees von Esenbeck to all other species. Its bark is the *cortex salicis laureæ* of some pharmacologists.

6. *SALIX PURPUREA*, Linn.; *Bitter Purple Willow*.—This species deserves notice on account of the intense bitterness of its bark.

DESCRIPTION.—Willow bark (*cortex salicis*) varies, in its appearance and qualities, according to the species and the age of the tree from which it is procured. In the dried state it is usually quilled and odourless. It should have a bitter and astringent taste.

COMPOSITION.—The bark of *Salix alba* was analyzed by MM. Pelletier and Caventou,¹ who obtained the following results: *Bitter yellow colouring matter*, *green fatty matter* similar to that found in cinchona, *tannin*, *resinous extract*, *gum*, *wax*, *woody fibre*, and a *magnesian salt* containing an organic acid.

These celebrated chemists failed to isolate *salicine*, which must have been contained in their bitter yellow colouring matter, either mixed or combined with some other matter. Their resinous extract is probably identical with what Braconnot calls *corticin*.

1. **TANNIC ACID**.—This is the astringent principle of willow bark. Sir H. Davy² gives the following as the quantities of tannin [impure tannic acid] in the bark of two willows:—

	480 lbs. of bark.	lbs. of tannin.
Leicestershire Willow	[<i>Salix Russelliana</i>] large size	33
Common willow	[<i>Salix</i> ?] large	11

2. **SALICINE**.—See p. 316.

CHEMICAL CHARACTERISTICS.—A decoction of the bark, made with distilled water, is coloured dark green (*tannate of iron*) by sesquichloride of iron; but, made with spring water, dark purple. Solution of gelatin produces a precipitate (*tannate of gelatin*) in the decoction, but tincture of nutgalls causes no turbidness. A strong decoction of willow bark, containing much salicine, is reddened by concentrated sulphuric acid.

PHYSIOLOGICAL EFFECTS.—Willow bark possesses both bitterness and astringency. It belongs, therefore, to the *astringent bitters*, whose effects have been already noticed (see vol. i., p. 244). It is less apt to disturb the stomach than cinchona, but its tonic and febrifuge powers are less than the latter. Vogt³ ascribes to it balsamic properties.

¹ Journ. de Pharm. t. vii. p. 123.

² Pharmacodynamik, Bd. i. S. 658.

³ Elements of Agricultural Chemistry, 4th edit. p. 83.

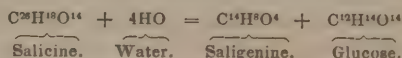
USES.—It has been employed as an indigenous substitute for cinchona. The indications for its use, therefore, are the same as those for the latter. It is given in intermittents, dyspeptic complaints accompanied with, or dependent on, a debilitated condition of the digestive organs, passive hemorrhages, chronic mucous discharges, in the stage of convalescence after fever, and as an anthelmintic. As a local astringent, the powder or infusion is sometimes employed, but there are many more efficient remedies of this kind.

ADMINISTRATION.—The dose of the *powder* is ʒss to ʒj. The *infusion* or *decoction* (prepared with ʒj of the bark and Oj of water) may be given in doses of from fʒj to fʒiij.

SALICINUM; *Salicine*.—Obtained in a more or less impure state by Brugnatelli, Fontana,¹ in 1825, and Buchner² in 1828, and in a pure state by Leroux³ in 1829. Has been found in about fourteen species of *Salix* and eight species of *Populus*.⁴ It has been detected in the bark, leaves, and flowers. Herberger obtained 250 grains, Merck 251 grains, from 16 ounces of the bark and young twigs of *Salix Helix*; Erdmann, however, procured, by another process, 300 grains from the bark of *Salix pentandra*.⁵ Merck's process for obtaining it, as stated by Liebig,⁶ is as follows:—

"Dried or fresh willow bark is cut small, and exhausted by repeated boiling with water. The decoctions are concentrated, and while boiling treated with litharge till the liquor appears nearly colourless. The dissolved oxide of lead is removed, first by sulphuric acid, afterwards by sulphuret of barium, and, after the separation of sulphuret of lead, evaporated, when salicine crystallizes; and is purified by repeated solution and crystallization (Merck). From willow bark, which is fresh and rich in salicine, it may be obtained by cautious evaporation of the cold aqueous infusion (Merck). The oxide of lead removes from the solution gum, tannin, and extractive matter, which would impede the crystallization of the salicine. It also combines with the salicine, forming a kind of salt which is decomposed by the sulphuric acid and sulphuret of barium. If the latter be carefully added, neither sulphuric acid nor baryta remain in the solution; and the sulphuret of lead, which separates, acts as a decolorizing agent."

Salicine crystallizes in silky needles and laminæ. It is white, very bitter, inodorous, neutral to vegetable colours, fusible at 230° F., and combustible at a higher temperature. It rotates to the left a ray of plane polarized light. It is much more soluble in boiling than in cold water, 100 parts of which dissolve only 5.6 parts of salicine. It is also soluble in alcohol, but not so in ether or the volatile oils. It is not precipitated by any agent. Oil of vitriol colours it blood-red.⁷ By this test the presence of salicine is detected in its solutions, and in decoctions of willow and poplar barks. Chromic acid (or a mixture of bichromate of potash and sulphuric acid) converts salicine (C²⁶H¹⁸O¹⁴) into hydruret of salicyl (also called salicylous acid), C¹⁴H⁵O⁴, II (*oil of meadow-sweet*) carbonic acid and formic acid. Hence this acid may be employed as a test for salicine. For this purpose 3 parts of salicine, 3 of bichromate of potash, and 24 of water, are to be dissolved in water, and to the solution 4½ parts of oil of vitriol diluted with 12 parts of water are to be added. On the application of heat, the well-known odour of the flowers of meadow-sweet (*Spiræa ulmaria*) is evolved. If diluted hydrochloric or sulphuric acid be boiled with a solution of salicine, the fluid becomes suddenly turbid, and deposits a precipitate of saliretine, glucose being at the same time formed.



¹ *Journ. de Chim. Méd.* t. i. p. 216, 1825.

² *Repert. für d. Pharm.* Bd. xxix. S. 411, 1828. Also *Journ. de Pharm.* xvi. 242.

³ *Ann. de Chim. et de Phys.* t. xliii. p. 440. Also *Journ. de Chim. Méd.* t. vi. p. 340, 1830.

⁴ Herberger. *Pharmaceutisches Central-Blatt für 1838*, S. 848.

⁵ *Ibid.* S. 552.

⁶ Turner's *Chemistry*, 7th edit. p. 816.

⁷ Phloridzin, veratria, piperin, oil of bitter almonds, &c. are also coloured red by oil of vitriol.

By the prolonged action of heat, saligenine loses the elements of water (2HO) and becomes saliretine ($\text{C}^{14}\text{H}^6\text{O}^9$).

Salicine has been repeatedly subjected to analysis.

	Atoms.	Eq. Wt.	Per Ct.	Piria. ¹			
				I.	II.	III.	IV.
Carbon	26	156	54.54	54.87	54.24	54.73	54.48
Hydrogen	18	18	6.29	6.36	6.39	6.43	6.31
Oxygen	14	112	39.17	38.77	39.37	38.84	39.21
Salicine	1	286	100.00	100.00	100.00	100.00	100.00

Salicine possesses tonic properties analogous to disulphate of quina, than which it is less liable to irritate the stomach. In its passage through the system salicine undergoes oxidation, and is converted into hydruret of salicylic acid, which is found in the urine. Its presence is detected by a persalt of iron, which strikes an intense violet colour with urine containing it.² It is employed in dyspepsia, intermittents, and other diseases for which cinchona and disulphate of quina are usually exhibited. In the event of the latter becoming scarce, salicine would prove an exceedingly valuable substitute. The dose of it is from 10 to 30 grains. It may be given in powder mixed with sugar or dissolved in some aromatic water.³ Its quickest action in intermittents is said to be obtained when it is given in powder.⁴

ORDER XXVI. CUPULIFERÆ, Richard.

CORYLACEÆ, Mirbel.

CHARACTERS.—*Flowers* unisexual: males amentaceous; females aggregate or amentaceous. *Males*: *Stamens* 5 to 20, inserted into the base of the scales, or of a membranous valvate calyx, generally distinct. *Females*: *Ovaries* crowned by the rudiments of an adherent (superior) calyx, seated within a coriaceous involucre (*cupule*) of various figure, and with several cells and several ovules, the greater part of which are abortive; *ovules* twin or solitary, pendulous or peltate: *stigmas* several, subsessile, distinct. *Fruit* a bony or coriaceous, 1-celled nut, more or less inclosed in the involucre. *Seeds* solitary, 1, 2, or 3: *embryo* large, with plano-convex, fleshy cotyledons, and a minute superior radicle.—*Trees or shrubs*. *Leaves* with stipules, alternate, simple, often with veins proceeding straight from the midrib to the margin (Lindley).

PROPERTIES.—The prevailing quality of this order is astringency, owing to the presence of tannic acid.

Besides the species presently to be described, the following may be here briefly referred to: *Quercus tinctoria*, or the *Black Oak*, is a native of America. Its bark, called *quercitron*, is used by dyers. In the United States it is employed medicinally, but it is said to be disposed to irritate the bowels.—The large capsules or acorn cups of *Quercus Ægilops* are imported from the Levant, under the name of *Felonias*. They are astringent, and are employed by dyers.—A saccharine substance exudes from the leaves of *Quercus mannifera* in Kurdistan.⁵

110. QUERCUS PEDUNCULATA, Willd.—THE COMMON BRITISH OAK.

Quercus Robur, Linn.

Sex. Syst. Monœcia, Polyandria.

(Cortex, L.—The Bark, E. D.)

HISTORY.—The oaks (*Quercus* of botanists) were held sacred by the Greeks, Romans, Gauls, and Britons. They are mentioned in the Old Testament.⁶ Both Dioscorides and Galen were acquainted with their astringent qualities. "Every part of the oak" (δρῦς; *Q. sessiliflora* and *pedunculata* according to Fraas, but

¹ Ann. de Chim. et de Phys. 3me Sér. t. xiv. p. 257, 1845.

² Laveran and Millon. Comptes Rendus. t. xix. p. 347; and Annuaire de Chimie, p. 585, 1845. These writers state that salicylic acid was also produced; but Wohler and Frerichs found that hydruret of salicylic acid did not become changed into salicylic acid in its passage through the system.

³ Blom, Benbacht. u. Beitr. z. die Salicine, Potsdam, 1835.

⁴ Lindley, Botanical Register, May and June, 1840.

⁵ Lond. Med. Gaz. Feb. 28, 1840.

⁶ Isaiah, i. 29, 30.

according to Sibthorp (*Q. Ægilops*), says Dioscorides,¹ “but especially the liber, possesses an astringent property.”

BOTANY. **Gen. Char.** Monœcious. **MALE FLOWERS:** *Catkins* lax and pendulous. *Perianth* lacerated. *Stamens* 5 to 10. **FEMALE FLOWERS:** *Involucre* scaly; the *scales* numerous, imbricated; combined with a coriaceous, hemispherical cup. *Perianth* 6-lobed, adnate to the ovary. *Ovary* 3-celled; 2 of the cells abortive. *Stigmas* 3. *Nut* 1-celled, 1-seeded, surrounded at the base by the cupule (*acorn-cup*). (*Bot. Gall.*)

Fig. 284*.



a. Male catkins. b. Magnified male flower. c. Female flower with the stigmas magnified. d. Acorn in embryo. e. Sections of young acorn. f. Cotyledon with the radicle.

Sp. Char.—*Leaves* deciduous, shortly-stalked, oblong-ovate, deeply sinuate; their sinuses rather acute, lobes obtuse. *Fruits* 2 or 3 upon a long peduncle (*Hooker*).

A large and handsome *tree*, remarkable for its longevity. *Twigs* round, smooth, grayish-brown. *Leaves* bright green, furnished with a single midrib sending off veins into the lobes. *Male flowers* yellowish; *females* greenish, tinged with brown.

The long peduncles which support the female catkins have given the name of *pedunculata* or *long-stalked* to this species of *Quercus* or *Oak*.

Hab.—Indigenous, growing in woods and hedges. Flowers in April. It is found in most European countries.

BARKING.—In the spring, the barks of trees contain more astringent matter, and are more readily separated from the wood. The usual time for barking the oak is from the beginning of May to the middle of July. The barkers make a longitudinal incision with a mallet furnished with a sharp edge, and a circular incision by means of a barking-bill. The bark is then removed by the peeling-irons, the separation being promoted, when necessary, by beating the bark with the square end of the mallet. It is then carefully dried in the air, by setting it on what are called *lofts* or *ranges*, and is afterwards stacked.²

DESCRIPTION.—Oak bark (*cortex quercus*) consists of pieces of from one to two feet long, which vary in their appearance according to the age of the stem or branch

¹ Lib. i. cap. 142.

² Loudon's *Encyclopædia of Agriculture*, 3d edit. pp. 656-9.

from which they have been taken. The bark of young stems is thin, moderately smooth, covered externally with a silvery or ash-gray cuticle, and is frequently beset with lichens. Internally it is, in the fresh state, whitish; but, when dried, brownish, red, fibrous. The bark of old stems is thick, very rough externally, cracked, and wrinkled, and is usually of inferior quality.

COMPOSITION.—According to Braconnot,¹ oak bark contains—*tannic acid*, *tannates of lime*, *magnesia*, *potash*, &c., *gallic acid*, *uncrystallizable sugar*, *pectin*, and *lignin*.

The quantity of **TANNIN** [impure tannic acid] obtained by Davy² from oak bark, is as follows:—

480 lbs. of	Tannin afforded.
Entire bark of middle-sized oak, cut in spring	29 lbs.
“ coppice oak	32
“ oak, cut in autumn	21
White interior cortical layers of oak bark	72

Biggins³ obtained 30 parts of tannin from the bark of an oak felled in winter, while the same weight of the bark of an oak felled in spring yielded him 108 parts.

CHEMICAL CHARACTERISTICS.—Decoction of oak bark reddens litmus, and becomes dark blue or purple (*tannate of iron*) on the addition of sesquichloride of iron. A solution of gelatin causes a precipitate (*tannate of gelatin*) with it. It is somewhat remarkable, however, that a solution of emetic tartar causes no precipitate with the decoction. [If alcohol be added to the decoction, concentrated to the consistence of a syrup, it causes the precipitation of *pectin*. A decoction, rendered alkaline by a fixed alkali, deposits a gelatinous matter (*pectic acid*) on the addition of acetic acid. Braconnot.]

PHYSIOLOGICAL EFFECTS.—The effects of oak bark are similar to those of other vegetable astringents containing tannic acid, and have been already described (see vol. i., p. 201).

USES.—The principal value of oak bark in medicine arises from its astringent property. Thus we employ a decoction of it as a gargle in relaxed conditions of the uvula, and in chronic inflammatory affections of the throat;⁴ as a wash in flabby, ill-conditioned, or bleeding ulcers; as an injection in leucorrhœa, in piles, or in prolapsus of the uterus or rectum; as an internal astringent in old diarrhœas, in the last stage of dysentery, in alvine hemorrhages, &c. Poultices made of powdered oak bark have been applied with benefit to mortified parts.⁵ Mr. Lizars⁶ states that he has obtained “wonderful success” in the cure of reducible herniæ by bathing the groin (the hernia having been previously reduced) three or four times daily with a warm inspissated decoction of oak bark, and then applying a truss. The practice, however, is not a new one.⁷

The inhalation of finely-powdered oak bark is said to have proved very beneficial in supposed cases of pulmonary consumption.⁸ I have already noticed (see vol. i., p. 175) the inspiration of impalpable powders of other astringents as a remedy for phthisis. Connected with this, the popular opinion of the exemption of operative tanners from phthisis pulmonalis deserves to be mentioned. Dr. Dods,⁹ who has paid some attention to this subject, concludes, that the popular notion is correct; and he ascribes the exemption to “the inhalation of that peculiar aroma, or volatile matter, which is constantly arising from tan-pits during the process of tanning with bark.” Hitherto, however, no sufficient evidence has been advanced to prove that tanners are exempt from the disease.

As a tonic, oak bark has been employed in medicine, but it is much inferior to the cinchona. Baths made of a decoction of this substance have been used by Dr. Eberle in the intermittents of very young children with benefit; and Dr. Fletcher,

¹ *Ann. de Chim. et de Phys.* t. i. p. 381.

² *Pfaff, Syst. d. Mat. Med.* Bd. ii. S. 207.

³ *Barton, Collection towards a Mat. Med. of the United States.*

⁴ *Ed. Med. and Surg. Journal*, July 1822.

⁵ See the references in Plouquet's *Literatura Medica*, t. ii. p. 297.

⁶ *Eberle, Treatise on Mat. Med.* 2d edit. vol. i. p. 263.

⁷ *Elem. of Agricult. Chem.* 4th edit. p. 83.

⁸ *Cullen, Mat. Med.* vol. ii. p. 45.

⁹ *London Med. Gaz.* vol. iii. p. 479.

of Virginia, has recommended the same remedy in *tabes mesenterica*.¹ The decoction, powder, and extract, have been taken internally in intermittents, but they are very apt to irritate the stomach. Dr. Cullen² says, that both by itself, and joined with chamomile flowers, he has prevented the paroxysms of intermittents.

ADMINISTRATION.—Dose of the powder from half a drachm to one or two drachms.

DECOCTUM QUERCÛS, L. E. D.; *Decoction of Oak Bark*.—(Oak Bark, bruised, \mathfrak{z} x [\mathfrak{z} iss, *D.*]; Water [Distilled, *L.*] Oij [Oiss., *D.*]. Boil down to a pint and strain.)—Used as a local astringent for various purposes, in the form of gargle, injection, or lotion. Administered in doses of f \mathfrak{z} ii to f \mathfrak{z} vi. Sometimes employed as a bath, especially for children.

III. QUERCUS INFECTORIA, Olivier.—THE GALL, OR DYER'S OAK.

Sez. Syst. Monœcia, Polyandria.

(Galla; Tumor ramuli a Cynipe; Gallæ tinctoriæ excitatus, *L.*—Gallæ; Excrecences, *E.*—Galls, the excrecences formed by *Diplolepis Gallæ tinctorium*, *D.*)

HISTORY.—Hippocrates employed the nutgall (κρηκίς) as an astringent, both internally and externally.³ Dioscorides⁴ describes it as the fruit of the oak; and the same error is found in the works of comparatively recent writers, as of Pomet.⁵

BOTANY. *Gen. Char.*—Vide *Quercus pedunculata*.

Sp. Char.—*Leaves* ovate-oblong, sinuate-dentate, very smooth, deciduous. *Fruit* sessile, very long.⁶

Small tree or shrub, from four to six feet high. *Stem* crooked. *Leaves* on short petioles, with a few short mucronate teeth on each side. *Acorn* two or three times as long as the cupules.

Hab.—Asia Minor, from the Bosphorus to Syria, and from the Archipelago to the frontiers of Persia.

FORMATION OF GALLS.—The term *gall* (*galla*) is applied to an excrescence or

Fig. 285.



Chinese Galls, or Woo-pei-tsze.

tumour formed on any part of a vegetable, in consequence of the puncture of an insect.

¹ Eberle, *op. cit.* vol. i. pp. 267-5.

² *Ed. Fœs.* pp. 609, 267. &c.

³ *Hist. of Drugs*, Engl. translation, 1712.

⁴ *Mat. Med.* vol. i. p. 45.

⁵ *Lib. i.* cap. 146.

⁶ Olivier, *Voy. dans l'Empire Ottom.* t. ii. p. 64.

In general, the insects which give rise to galls are the gall-flies, constituting the genus *Cynips*, and forming the tribe *Gallicolæ* (*Diphlolepariæ*, Lat.) of the order *Hymenoptera*. But sometimes they are plant-lice, or *Aphidii* of the order *Homiptera*. Thus the very astringent *Chinese galls* called *Woo pei-tze* (Fig. 285), of which I have elsewhere¹ given a description, are produced, as the late Mr. Doubleday² has shown, by an Aphidian.

The gall-flies (*Cynips*) are those by whose puncture the officinal galls are produced, and to which, therefore, our attention must be principally directed. The females of these insects are supplied with an ovipositor, called by Latreille the *borer* (*terebra*), channelled with lateral teeth.—By means of this instrument they are enabled to perforate the foliaceous or cortical parts of plants for the purpose of depositing their eggs, along with an acrid liquor, in the wound thus made. The irritation thereby produced gives rise to an influx of the juices of the plant to the wounded part, and an excrescence is formed, which is termed a *gall* (*galla*). Here the insect usually undergoes its transformations: the egg produces the larva (or maggot), which feeds on the juices of the plant, and is changed into the pupa. This afterwards becomes the perfect insect (*imago*), and, perforating the gall, produces a small, round hole, through which it escapes from its prison-house.

The external form and appearance of galls are very constant when formed by the same insect, on the same part of the same plant; but the galls of different species of vegetables, and of different parts of the same plants, as well as those of the same vegetable species, produced by a different insect, vary considerably. There is reason for believing that the form and appearance of the gall is determined more by the insect than by the plant; for we sometimes have on the same oak two kinds of galls, of very dissimilar appearance, produced by different insects.

OAK GALLS.—Most, if not all plants, but especially the oaks, are liable to the production of galls. The *oak galls* vary considerably in size, shape, texture, and other properties, according to the species and part of the oak in which they grow, and the insect by whose puncture they are produced. From their fancied resemblance to nuts, apples, currants, &c., they have been respectively called, *nut-galls*, *apple-galls*, *currant-galls*, *grape-galls*, *cherry-galls*, *artichoke-galls*.³

The largest species of British oak-galls is the *oak-apple* or *oak sponge*, produced by *Cynips Quercus terminalis*. They are astringent, like nutgalls.

The small round *currant-galls* are produced by *C. Q. pedunculi*. They are scattered over the rachis of the amentum, giving it the appearance of a bunch of currants.

The *artichoke-gall* or *oak-strobile* is a beautiful foliose gall, produced by *C. Q. gemma*.

Galls of various species are produced on oak-leaves. One of the larger sorts is red and succulent, and has been called the *cherry gall*. A smaller one is called by Reaumur the *currant-gall*. Mr. Westwood states that the large ones (as large as a boy's marble) are formed by *C. Q. folii*.

The large *Mecra* or *Bussorah galls*,⁴ sometimes called *Dead-sea apples*, *mad-apples* (*mala insana*), or *apples of Sodom* (*poma sodomitica*), are produced on the *Quercus infectoria* by a species of *Cynips* which Mr. Westwood calls *C. insana*.

A very irregular, deeply-furrowed, angular gall is formed on the capsule of the *Quercus pedunculata* by the *Cynips Quercus calycis*. This is the *acorn gall*. It is sometimes used in Germany by dyers as a substitute for nutgalls under the name of *Knoppern* or *Knobben*. These galls appear to me to be identical with some which I have received from M. Guibourt under the name of *gallon de Hongrie ou du Piémont*. The acorn, with its capsule, is usually attached to it. A very similar shaped gall, attached by its middle to a young branch, is frequently found intermixed: this M. Guibourt calls the *horned gall* (*galle corniculée*).

NUTGALLS.—The *nutgalls* (*gallæ officinarum*) of commerce are produced by the *Cynips gallæ tinctoriæ* on the *Quercus infectoria*. Ollivier⁵ says that this insect lives on this species of *Quercus* only.

On the sides and at the ends of the branches and shoots of this tree, the female

¹ *Pharmaceutical Journal*, vol. iii. p. 384, 1844.

² *Ibid.* vol. vii. p. 310, 1848.

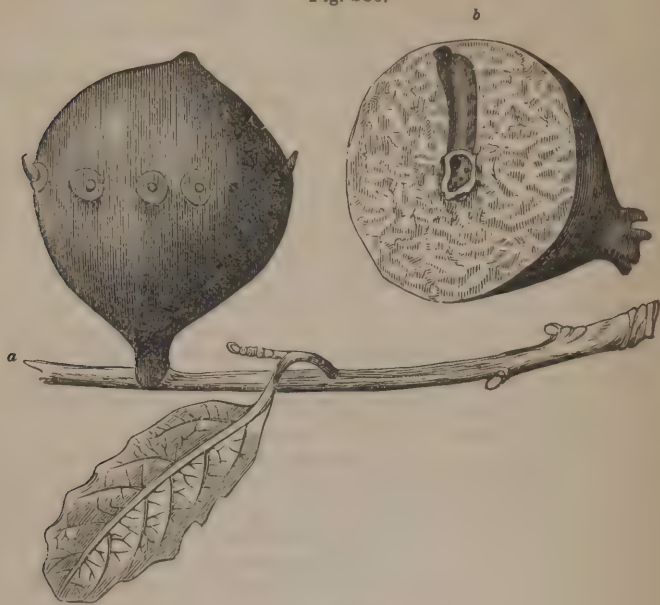
³ For further details respecting galls, the reader is referred to Reaumur's article on this subject, in his *Mémoires pour servir à l'Histoire des Insectes*, 4to. vol. iii. 1737. Also to Westwood's *Introduction to the Modern Classification of Insects*, 2 vols. 8vo. 1838-40.

⁴ See a notice of this gall, by the author, in the *Pharmaceutical Journal*, vol. viii. p. 423.

⁵ *Op. cit.*

makes a puncture and deposits her egg. An excrescence is soon formed, within which the larva is developed, which is changed first into the pupa and then into

Fig. 286.

*Mecca or Bussorah Galls.*

a. Branch, bearing a gall.

b. Section of a gall.

the imago. As soon as the perfect insect is produced, it eats its way out. If we examine those galls from which the animal has escaped, we observe externally a circular hole, of about a line in diameter, leading to a canal of from $2\frac{1}{2}$ to $3\frac{1}{2}$ lines long, which passes to the centre of the gall. But in those galls in which the insect has not put off its pupa state, we find neither an external hole nor an internal canal. In the imperforated gall, the part sometimes called "the kernel" is the cocoon of the insect in the pupa state (Kirby and Spence). Guibourt¹ states that in the immediate envelop of the central cavity of the gall he detected starch grains, and, in the exterior covering, chlorophylle and volatile oil. Guibourt has also observed, around the spherical amylaceous mass, cells serving for the respiration of the insect.

Bluish black, heavy, not yet perforated. *Ph. L.*

Those galls from which the insect has escaped are commonly larger, lighter coloured, and less astringent: they are termed *white galls*.

The nutgalls of different countries vary in their size, shape, weight, and quality of surface.

1. *Levant Nutgalls (Gallæ Levanticæ)*.—These are the ordinary nutgalls of the shops. They are in general about the size of a nut, somewhat round, tuberculated or warty; whence they were formerly called spiny or prickly galls (*gallæ à l'épine*, *gallæ spinosa*), to distinguish them from the smooth French and other galls. They are imported from Syria and Turkey. The most esteemed *Syrian galls (gallæ syriacæ)* are the produce of Mosul on the Tigris: these are the *Mosul galls (gallæ mossulicæ)*. The *Aleppo galls (gallæ haleppenses)* usually pass for Mosul galls. *Tripoli galls (gallæ tripolitanæ)* come from Tripoli (also called Taraplus or Tara-

¹ *Hist. Nat. des Drogues simples*, 4me édit. t. ii. 1849.

balus, whence the corrupt name of "Tarablous galls"), and are inferior to the Aleppo galls. The *Turkey galls* (*gallæ turcicæ*) usually come from Constantinople or Smyrna. *Smyrna galls* (*gallæ smyrnenses*) are not so heavy, are lighter coloured, and contain a larger admixture of white galls than those brought from Aleppo. The galls brought from Bombay (*East India galls*) are probably the produce of Persia or neighbouring parts.¹

In commerce, three kinds of Levant galls are distinguished, viz., *black* or *blue*, *green*, and *white*; but there is no essential distinction between the first two.

α. *Black or blue nutgalls* (*gallæ nigræ seu cæruleæ*); *green nutgalls* (*gallæ virides*).—These are gathered before the insect has escaped, and are called by the natives *yerli*. They vary from the size of a pea to that of a hazel-nut, and have a grayish colour. The smallest have a blackish-blue tint, and are distinguished by the name of *black* or *blue galls*; while the larger and greener varieties are called *green galls*. Externally they are frequently tuberculated, but the surface of the tubercles and of the intervening spaces is usually smooth. Their texture is compact, but fragile. They have no odour, but a styptic and powerfully astringent taste.

β. *White galls* (*gallæ albæ*).—These are for the most part gathered after the insect has escaped, and hence they are perforated with a circular hole. They are larger, lighter coloured (being yellowish or whitish), less compact, less heavy, and less astringent. They are of inferior value.

γ. The *marmorine nutgalls* (*gallæ marmorinæ*, Guibourt) of the French writers are a sort of Levant gall about the size of the black or blue galls, but without tubercles or warts. The surface, however, is dull and roughish, something like orange berries. Their shape is round, with sometimes a little elongation where the peduncle is attached.

δ. *Small Aleppo nutgalls*.—Occasionally there is imported from Aleppo a small sort of nutgall, called the *coriander gall*.

Somewhat larger than these is another sort of small Aleppo gall, called the *small crowned Aleppo galls* (*gallæ haleppenses coronatæ*). They are about the size of a pea, or a little larger, and crowned superiorly by a circle of points or tubercles like the fruit of the myrtle or *Eugenia*. Although very small, they are often perforated by a large hole, so that they must have attained their maximum size; and, therefore, are a distinct sort from the usual Aleppo kind.

Somewhat larger than these, and having a speckled surface, is a sort which I have received under the name of *Turkish diamonds*.

2. *European Nutgalls*.—Various sorts of nutgalls are produced in Europe. The *Istria nutgalls* are intermediate in size between the usual Levant galls and the small Aleppo sort. They are somewhat turbinate or pear-shaped, wrinkled, and usually have a short peduncle. The *Morée nutgalls* are about the size of the preceding. *French nutgalls* are spherical, very light, usually very smooth or even polished, but sometimes very slightly wrinkled. *Hungarian, Italian, Bohemian, &c. nutgalls* are but little known in England.

COMPOSITION.—Nutmalls were analyzed by Sir H. Davy,² who obtained the following results:—

Matter soluble in water = 37; viz.	{	Tannin	26.0
		Gallie acid, with a little extractive	6.2
		Mucilage and matters rendered insoluble by evaporation	2.4
		Carbonate of lime and saline matter	2.4
Matter insoluble in water (<i>lignin</i>)			63.0
Good Aleppo nutgalls			100.0

Pelouze³ found in 100 parts of nutgalls the following constituents: *tannic acid* 40.0, *gallie acid* 3.5, *ellagic acid* and *insoluble matter* 50, *extractive colouring matter* 6.5=100.0.

¹ *Mat. Indica*, vol. i. p. 145.

² *Ann. de Chimie et de Physique*, t. liv. p. 337.

³ *Phil. Trans.* for 1830.

1. TANNIC ACID (see p. 325).

2. GALLIC ACID (see p. 326).

3. ELLAGIC OR BEZOARDIC ACID (*Acidum Ellagicum* vel *Bezoardicum*). $C^{14}H^2O^7, 3HO$.—Discovered by Braconnot, who called it *ellagic acid*, from the French word *galle* spelt backwards. It is probably produced by the slow decomposition of the tannin contained in the nutgall. It is a yellowish gray insipid powder, scarcely soluble in cold water, a little more so in alcohol, but insoluble in ether. Like the tannic and gallic acids it forms a bluish black precipitate with the persalts of iron. Hot nitric acid, according to Braconnot, gives it a blood-red colour. The acid has recently acquired additional interest in consequence of the discovery by Mr. Thomas Taylor¹ (subsequently confirmed by Merklein and Wöhler²) that the *Oriental Bezoar* is an ellagic acid calculus formed in the intestines of animals (usually a species of wild goat, termed by the Persians *Pasen*), which feed on vegetable substances containing tannin, from which the ellagic acid is produced. Ellagic acid, therefore, must be regarded as identical with *bezoaric* (*Bezoarstoff* of John).

CHEMICAL CHARACTERISTICS.—Infusion of nutgalls reddens litmus paper, forms an inky compound (*tanno-gallate of iron*) on the addition of a sesquisalt of iron, and a yellowish white precipitate (*tannate of gelatin*) with a solution of gelatin. If a piece of skin, depilated by lime, be immersed in the infusion, and agitated with it from time to time, all the tannic acid is absorbed, the filtered liquor striking a blue colour (*gallate of iron*) with the sesquisalts of iron, but giving no precipitate with a solution of gelatin. Infusion of galls forms precipitates (*metallic tannates* or *tanno-gallates*) in many metallic solutions; it also produces a precipitate (*a tannate*) in aqueous solutions of the vegetable alkaloids.

TABLE OF METALLIC PRECIPITATES BY A STRONG INFUSION OF GALLS.³

Metal.	Solution employed.	Precipitate according to ⁴	
		Brande.	Dumas.
Manganese	Neutral protochloride	Dirty yellow	0
Iron	Neutral protosulphate	Purple tint	0
Iron	Persulphate	Black	Blue-black.
Zinc	Chloride	Dirty yellow	0
Tin	Acid protochloride	Straw-yellow	Yellowish.
Tin	Acid perchloride	Fawn-yellow	Yellowish.
Cadmium	Chloride	(?)	0
Copper	Protochloride	Yellow-brown	?
Copper	Nitrate	Green	Gray.
Lead	Nitrate	Dingy yellow	White.
Antimony	Emetic tartar	Straw-yellow	White.
Bismuth	Tartrate of bismuth and potassa	Yellow-and copious	Orange.
Cobalt	Chloride	0	Yellow-white.

PHYSIOLOGICAL EFFECTS.—As nutgalls contain a larger portion of tannic acid than any other known vegetable production, they possess in the highest degree the properties of an astringent (see vol. i. pp. 200 and 243).

USES.—The following are the principal uses of nutgalls:—

1. *As a tonic in intermittents*.—Notwithstanding Poupert's favourable report of the use of galls in these cases, they scarcely deserve notice, as we have in arsenic, cinchona, and sulphate of quinia, much more effective and certain febrifuges.

2. *As an astringent in hemorrhages*, especially passive alvine hemorrhages.

3. *In chronic mucous discharges*, as old diarrhœas.

4. *As a chemical antidote* (see vol. i., p. 198).—Nutgalls may be given in poisoning by ipecacuanha, emetina, the organic alkalies generally, and those vegetable productions whose activity depends on an organic alkali; as opium, white hellebore, colchicum, nux vomica, &c. Their efficacy arises from the tannic acid, which combines with the vegetable alkali to form a tannate possessing less activity than the other salts of these bases; perhaps because of its slight solubility. Nutgalls

¹ Lond. and Edinb. Philosoph. Magazine for May 1844, and also for January 1846; and Catalogue of the Museum of the Royal College of Surgeons, published in July 1845.

² Ann. der Chem. u. Pharm. Bd. lv. S. 129, 1845.

³ Brande's Manual of Chemistry. 1818.

⁴ Discrepancies arise from the strength of the solutions as well as from their acid or basic characters, so that neutral solutions should as far as possible be used.

are recommended as an antidote in cases of poisoning by emetic tartar, but I very much doubt their efficacy (see vol. i. p. 670).

5. *As a topical astringent*.—Nutmalls are applicable in any cases requiring the topical use of a powerful vegetable astringent. Thus, in the form of gargle, in relaxation of the uvula; as an injection, in gleet and leucorrhœa; as a wash, in flabby ulcers, with profuse discharge; *prolapsus ani seu vaginæ*; in the form of ointment, in piles, &c.

ADMINISTRATION.—The dose of the powder is from ten to twenty grains. Nutgalls are also used in the form of *infusion* and *tincture*.

Roasted nutgalls (*gallæ torrefactæ*) are used in the manufacture of copying-ink (see p. 329).

Besides the following official formulæ for the use of galls, others have been published by Mouchon.¹

1. **INFUSUM GALLÆ**; *Infusion of Galls*.—Prepared by digesting ℥iv of coarsely powdered nutgalls in f℥vj of boiling water.—Employed as a chemical antidote and as a reagent or test (see *ante*, p. 324). The dose is from f℥ss to f℥ij; or, in cases of poisoning by the vegetable alkalies, f℥iv.

2. **TINCTURA GALLÆ**, L. D. [U. S.]; *Tinctura Gallarum*, E.; *Tincture of Galls*.—(Galls, bruised, ℥v; Proof Spirit Oij. Macerate for seven [fourteen, D.] days, and filter. [Galls, bruised, ℥iv; Diluted Alcohol Oij. Macerate for fourteen days, and filter, U. S.] “This tincture may be prepared either by digestion or percolation, as directed for tincture of capsicum,” E.)—A powerful astringent. Dose from f℥ss to f℥ij. Diluted with water, it forms a very useful and convenient astringent gargle and wash. Its principal use is as a chemical test, especially for the persalts of iron, gelatin, and the vegetable alkaloids. After it has been kept for some time its tannic acid becomes converted into gallic acid, and it then ceases to occasion precipitates in solutions of gelatin and of the vegetable alkaloids.

3. **UNGUENTUM GALLÆ**, D. [U. S.]; *Ointment of Galls*.—(Galls, in very fine powder, ℥j; Ointment of White Wax ℥vij. Mix them.)—[Galls, in powder, ℥j; Lard ℥vij. Mix them, U. S.]—Astringent. Mixed with zinc ointment it is applied to piles after the inflammatory stage is passed. The above is Dr. Cullen’s formula; but Mr. B. Bell² recommends an ointment composed of equal parts of powdered galls and hog’s lard or butter, in external hemorrhoidal swellings. [A smoother ointment, and one which leaves no gritty, rough deposit on irritable surfaces, is prepared by adding ℥j of Aqueous Extract of Galls to ℥j of Simple Ointment.—Ed.]

4. **UNGUENTUM GALLÆ COMPOSITUM**, L.; *Unguentum Gallæ et Opii*, E.; *Compound Ointment of Galls*.—(Galls, in fine powder, ℥vj; Opium, powdered, ℥iss; Lard ℥vj. Mix.—The *Edinburgh College* orders of Galls, in fine powder, ℥ij; Opium, in powder, ℥j; Axunge ℥j.)—An excellent astringent application to *blind piles* (i. e. piles without hemorrhage) and *prolapsus ani*. The opium diminishes the pain which the galls might otherwise occasion, where the hemorrhoidal tumours are very sensible. From ℥ss to ℥i of camphor is frequently added to this ointment.

5. **ACIDUM TANNICUM**, L. D. [U. S.]; *Acidum Quercitannicum*; *Tannic Acid*: in the impure state called *Tannin*, the *Tanning Principle*, or *Materia Scytodaphica* (σχυροδερφικός, belonging to curriers).—Extracted from nutgalls by ether in the percolation or displacement apparatus.³ The ether employed is that of commerce (which contains about 10 per cent. of water). The tannic acid at first dissolves in the ether, but is afterwards precipitated, in the form of a thick syrup, by the water contained in the ether. The syrupy layer is to be repeatedly washed with pure ether, and afterwards evaporated *in vacuo*, or at a temperature not exceeding 212° F. The residue is almost pure tannic acid.

¹ *Gaz. des Hôp. Civ. et Milit.* 13 Avril, 1837.

² Pelouze, *Ann. de Chim. et de Physique*, t. liv.

³ *Syst. of Surgery*.

Galls, in tolerably fine powder, $\bar{3}$ viij: Sulphuric Ether Oij; Distilled Water $\bar{3}$ v. Incorporate the water and ether by agitation, and pour the resulting solution, in successive portions, upon the galls, previously introduced into a glass or porcelain percolator. The liquid which accumulates in the lower bottle will consist of two distinct strata, the heavier of which is to be separated and evaporated to dryness, finally applying an oven heat, which, however, should not exceed 212° . From the lighter liquid the ether may be removed by distilling it by means of a water-bath, and with the aid of a Liebig's condenser.—D.

Tannic acid is a spongy, brilliant, light, odourless white, or commonly yellowish, solid. It dissolves in water, alcohol, and ether; but less so in ether than in alcohol. In the solid state it is unalterable in the air; but, dissolved in water, it absorbs oxygen, and is transformed into carbonic acid, which escapes, and gallic acid, which remains in solution: hence it should be dissolved only at the time we are about to use it.

The following are the *characteristics* of this substance: It has an intensely astringent taste, and produces, with a solution of gelatin, a white precipitate (*tannate of gelatin*); with a solution of a sesquisalt of iron, a deep blue compound (*tannate of iron*: see vol. i. p. 711); and with solutions of the vegetable alkalies, white precipitates (*tannates*) slightly soluble in water, but very soluble in acetic acid. The mineral acids also cause precipitates with concentrated solutions of tannic acid, as do the alkalies and their carbonates. Gelatinous alumina rapidly absorbs tannic acid from its solution, and forms an insoluble compound with it.

Almost colourless; its solution in water is strongly astringent; with a solution of isinglass it produces a white precipitate. In other respects it agrees with the characters assigned to gallic acid. *Ph. Lond.*

Tannic acid is composed of $C^{18}H^6O^{12} = C^{18}H^5O^9, 3HO$; consequently its equivalent or atomic weight is 212. Its symbol is $\overline{Tan}, 3HO$; or $Qt, 3HO$.

Tannic acid is employed in medicine, in chemistry, and in the arts.

Considered as a medicine, tannic acid is a powerful agent of the astringent class. As a *topical* remedy it is probably the most powerful of all vegetable astringents or styptics. Its chemical action on fibrine, albumen, and gelatin explains this. It is the active principle of a very large proportion of vegetable astringents (see vol. i., pp. 200 and 243). Given to a dog in doses of from $7\frac{1}{2}$ grains to about 93 grains, it did not affect the health of the animal: it caused constipation, but its appetite remained the same. The urine gradually became darker coloured and opaque, and was found to contain both gallic and pyrogallic acids and humus-like substances. The tannic acid had become converted into these bodies in its passage through the animal system.¹ The gallic acid was detected by the blackish blue precipitate produced by the persalts of iron, and by no precipitate being produced with gelatin. Pyrogallic acid was detected by the bluish black precipitate produced by the proto-salts of iron. On the human subject tannic acid also operates as a constipating agent when given in a sufficient dose and frequently repeated. Cavarra² states that $2\frac{1}{2}$ grains taken three days successively produced this effect on himself. The *remote* effects of tannic acid are not so obvious, but they appear to be astringent, though in a much feebler degree. As the tannic acid becomes changed into gallic acid in its passage through the system, it is probably the latter agent which operates on remote parts as an astringent when tannic acid is administered. If this opinion be correct, tannic acid would act, as Dr. Garrod³ has suggested, less powerfully as a remote astringent than an equal weight of gallic acid. But, as a topical astringent, tannic is far more powerful than gallic acid; because its chemical reaction on albumen, gelatin, and fibrine is more energetic.

Tannic acid is used as an astringent chiefly in hemorrhages and profuse secretions; and also to constrict relaxed fibres. In hemorrhages, it has been used both topically, as a styptic (in bleeding gums, piles, and uterine hemorrhage), and remotely, as an astringent (in hemorrhage from the lungs, stomach, bowels, kidneys,

¹ Wöhler and Frerichs, *Chemical Gazette*, vol. vi. p. 231, 1848.

² Cavarra, *Lond. Med. Gaz.* vol. xx. p. 171, 1837.

³ *Lancet*, Dec. 30, 1848.

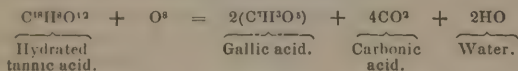
and uterus). In chronic fluxes it has likewise been employed both as a topical and a remote remedy: topically in gonorrhœa, gleet, leucorrhœa, and ophthalmia; remotely in pulmonary catarrh, diarrhœa, dysentery, leucorrhœa, gonorrhœa, and cystirrhœa. To restrain the phthisical sweating it has been recommended by Charvet and others, and Giadorow¹ states that, given in combination with opium, he cured (?) two cases of diabetes by it. To constringe fibres, it is applied to spongy gums and prolapsed bowel. As an application to sores, it has been employed by Ricord in chancres, and by Mr. Druitt² in sore nipples. Dr. Scott Alison³ has recently recommended its use in various other cases: as a tonic or peptic in dyspepsia; as an "histogenetic" to promote the genesis and improve the quality of the blood, in rickets, &c.; as a nervine in nervous debility and languor; and to arrest or retard the growth of heterologous formations (tubercle, malignant disease, &c.). It has likewise been given as an antidote to check excessive vomiting from ipecacuanha or emetina.—Tannic acid may be administered in doses of from 3 to 10 or more grains, in powder, pill, or solution. When we employ it as a remote agent, the pill-form seems to be the most appropriate mode of exhibition.—As a lotion or injection, it may be used in the form of aqueous solution containing from 4 to 6 or more grains in the fluidounce. It has also been employed in the form of ointment composed of ʒij of the acid dissolved in fʒij of distilled water and mixed with ʒxij of lard.

In chemistry, tannic acid is employed as a reagent or test. Its solution should be fresh made when used.

In the arts it serves various useful purposes. It is the active principle of the tanning substances. In the manufacture of white wines it is used to coagulate the substance called *glaiadine*, which is apt to excite the viscous fermentation in these wines.

6. ACIDUM GALLICUM, L. D. [U.S.]; *Gallic Acid*.—It is usually prepared by exposing for a long time an infusion of nutgalls to the air; removing now and then a mouldy skin which forms on the surface of the liquid. A sediment of impure gallic acid is obtained, which requires to be purified by solution in boiling water, decolorized by animal charcoal, and crystallized.

In this process the tannic acid of the nutgalls absorbs atmospheric oxygen, and is converted into gallic acid, carbonic acid, and water.



This process is favoured by the presence of a nitrogenized matter which acts as a ferment; and the decomposition is termed the *gallic fermentation*. The mouldy skin which forms on the surface is called *mycoderma*, and resembles mother of vinegar (see *ante*, p. 85).

Galls, in coarse powder, lb. j; Distilled Water, as much as may be necessary. Having placed the galls in a porcelain dish, pour on as much water as will convert them into a thick paste, and keep them in this moistened condition for six weeks, at a temperature of between 60° and 70°, adding water from time to time, so as to supply what is lost by evaporation. Let the residue be boiled for twenty minutes, with forty-five ounces of water, and then placed on a calico filter. The filtered solution, on cooling, will afford a copious precipitate. Let this be drained on a calico filter, then subjected to strong expression, after having been first enveloped in blotting paper, and again dissolved in ten ounces of boiling water. When, upon ceasing to apply heat, the solution has cooled down to 80°, pour it off from the crystals which have formed, and, having washed these with three ounces of ice-cold water, dry them—first in blotting paper, and finally by a steam or water heat.

By boiling the undissolved portion of the galls with forty-five additional ounces of water, filtering into a capsule containing the liquor decanted from the crystals formed in the preceding process, evaporating down to the bulk of ten ounces, and cooling to 80°, an additional quantity of the crystallized acid will be obtained.

¹ *Annali universali, di Medicina*, quoted by Dr. Dunglison, in his *New Remedies*, 5th edit. 1846.

² *Provincial Med. Journal*, Oct. 9, 1844.

³ *London Journal of Medicine*, 1850.

Or: Galls lb. j; Oil of Vitriol of commerce f℥xxvj; Water Ov. ℥xiv. Steep the galls for twenty-four hours in one pint of the water, then transfer them to a glass or porcelain percolator, and pour on a pint and a half of the water in successive portions. Dilute five ounces of the oil of vitriol with an equal bulk of water, and, when the mixture has cooled, add it to the infusion obtained by percolation, stirring well, so as to bring them into perfect contact. Let the viscid precipitate which forms be separated by a filter, and to the solution which passes through, add five ounces more of the oil of vitriol, which will yield an additional precipitate. This being added to that previously obtained, let both be enveloped in calico, and subjected to powerful pressure. Dissolve the residue in the rest of the oil of vitriol, this latter being first diluted with what remains of the water; boil the solution for twenty minutes, then allow it to cool, and set it by for a week. Let the deposit which has formed at the end of this period be pressed, dried, and then dissolved in three times its weight of boiling water, clearing the solution, if necessary, by filtration, and, when it has cooled down to 80°, decant the liquid from the crystalline sediment which has formed, and wash the latter with three ounces of ice-cold water. Finally, let it be transferred to blotting paper, and, when deprived by this of adhering liquid, let it be dried perfectly, at a temperature not exceeding 212°.

The gallic acid obtained by either of the preceding processes may be rendered nearly white by dissolving it in twenty times its weight of boiling distilled water, and causing the solution to traverse a stratum of prepared animal charcoal spread upon a calico filter. When the liquid passes through colourless, it should be evaporated to one-sixth of its volume, and then suffered to cool, in order to the separation of the crystallized acid.—*D.*

Pure gallic acid is a colourless, crystallizable acid, with an acidulous and styptic taste. It is soluble in water, alcohol, and slightly so in ether. It produces a deep blue colour with the salts of the sesquioxide of iron, in which circumstance it agrees with tannic acid, but it differs from the latter acid in not precipitating gelatin or the salts of the alkaloids. To detect gallic acid mixed with tannic acid, the latter is to be previously removed from its solution by immersing in it a piece of skin depilated by lime. The tannic acid is absorbed. The gallic acid may then be detected by the salts of the sesquioxide of iron.

Colourless; destroyed by fire. Soluble both in water and in rectified spirit. It strikes a bluish black colour with solutions of the sesquioxide of iron; but produces no precipitate with a solution of isinglass. *Ph. Lond.*

It does not occasion any precipitate with the salts of the protoxide of iron. By this it is distinguished from pyrogallie acid.

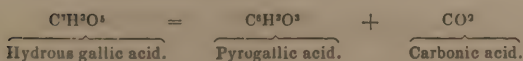
Gallic acid consists of $C^6H^3O^5$; hence its equivalent or atomic weight is 85. When heated to 410° or 420° F., it gives out carbonic acid, and is resolved into *pyrogallie acid* ($C^6H^3O^3$). If this acid is heated to 480° F., it gives out water and becomes *metagallic acid* ($C^{12}H^3O^3$).

Gallic acid is employed in medicine as an astringent; but as a topical agent it is greatly inferior to tannic acid. Unlike the latter acid it causes precipitates neither in gelatinous nor in albuminous solutions: and a piece of skin does not absorb gallic acid from its aqueous solution, as it does tannic acid from its solution. Its chemical action on the constituents of the animal tissues is thus much weaker than that of tannic acid. No obvious effects result from the introduction of a few grains into the stomach. Twenty-four grains have produced a sweetish taste and a slight feeling of internal heat; but no other effect.¹ It has been administered in doses of from fifteen to thirty grains against the *Tænia Solium*, but without any benefit. For the reasons already stated (see *ante*, p. 326) it is probable that, in equal doses, it is more powerful, as a remote astringent, than tannic acid. Dr. Todd² says that in all cases of hemorrhage, whether hæmoptysis, hæmatemesis, hæmaturia, or any other form dependent on hemorrhagic tendency, he considers it to be the best styptic we possess. The dose of it is from three to ten grains or more three or four times a day. It may be used in the same forms as tannic acid (see *ante*, p. 326).

7. ACIDUM PYROGALLICUM; *Pyrogallie Acid.*—At a temperature of from 410° to 420° F., gallic acid is converted into pyrogallie acid and carbonic acid.

¹ Chevallier, *Dict. des Drogues*, t. i. p. 93, Paris, 1827.

² *London Medical Gazette*, N. S. vol. viii. p. 101, January 19, 1849.



Pyrogallic acid is a crystallizable volatile acid. It is more soluble in water than gallic acid. It produces a very intense blue colour with the salts of the protoxide of iron, and by exposure to the air it absorbs oxygen, and is converted into a dark brown substance, which is insoluble in water and alcohol.

Pyrogallic acid, in an impure form, is employed in the preparation of a hair dye and of copying ink. By the dry distillation of galls, it is obtained partly in the form of a sublimate, partly in the fluid form. The sublimate and fluid are to be dissolved in distilled water, the solution deodorized by animal charcoal, concentrated by evaporation, and then mixed with spirit of wine and some agreeable volatile oil. The resulting compound is a *hair-dye*, which stains the hair dark brown; and the tint is not removed by sweat or moisture. It must be cautiously applied, as it stains the hands.¹ Roasted nutgalls are used in the manufacture of copying ink on account of the dark colour which the pyrogallic acid produces with the sulphate of the protoxide of iron.

[*Quercus Tinctoria*, Bartram.—Black or Dyer's Oak.

Sex. Syst. Monœcia, Polyandria.

Gen. Char.—See *ante*, p. 318.

Sp. Char.—The *leaves* are obovate or oblong, sinuate, lobed, pubescent beneath. *Male flowers* in slender, long, filiform aments. *Cup* turbinate. *Acorn* small, ovoid, flattened at top.

This is one of the largest forest-trees of the United States, attaining, in favourable situations, the height of ninety or one hundred feet, with spreading branches, and a rough, dark-coloured bark.

The bark when separated is thick and rugged, full of fissures, and black externally; internally, it is fibrous and of a red colour increased by drying. It breaks with a rough fracture. That obtained from the young shoots and smaller branches is smoother externally, and the inner fibres are finer. The odour is strong, and the taste is bitter and styptic, tinging the saliva yellow when chewed. The cellular integument contains a yellowish-brown colouring principle. The interior layer when separated constitutes *Quercitron Bark*, used for the purpose of dyeing; it is shipped to Europe.

In consequence of the colour imparted to leather, it is not as much used for tanning. As it soils the clothes an objection is urged against it in medicine.

The medical properties and uses are the same as those enumerated under *Q. pedunculata*.

Quercus Alba, Linn.—White Oak.

Sex. Syst.—Monœcia, Polyandria.

Gen. Char.—See *ante*, p. 318.

Sp. Char.—*Leaves* obovate, oblong; obliquely divided into obtuse lobes; *segments*, oblong entire; *cup* hemispherical, tuberculated; *acorn* ovoid, oblong; *fruit* in pairs.

This tree is less elevated than the *Q. tinctoria*. It forms, however, a larger and more regularly-expanded head, with numerous horizontal branches. The trunk and branches have a whitish hue, hence the name *White Oak*. The leaves are of a silvery appearance, with a hoary under surface. The young leaves are covered with a fine silky down.

The bark is rough externally, of a light colour; the effete epidermis being arranged in flat layers. On drying, the internal layer becomes brown. It breaks with a stringy fracture. The odour is decided and tan-like; taste astringent and bitter. This bark is used in tanning. For medicinal purposes it is preferred to the black oak.

¹ *Pharmaceutical Journal*, vol. iii. p. 585, 1844.

DECOCTUM QUERCUS ALBÆ, U. S.; *Decoction of White Oak Bark.*—(Take of White Oak Bark, bruised, an ounce: Water a pint and a half. Boil down to a pint and strain.)—Used as the *Decoctum Quercus*, p. 320.]

112. *Quercus Suber*, Linn.—The Cork-Tree.

Sex. Syst. Monœcia, Polyandria.

(Cortex.)

Θελλός, Theophrast., *Hist. Plant.* lib. iii. cap. 16; *Suber*, Eliny, *Hist. Nat.* lib. xvi. cap. 13. and lib. xxiv. cap. 8.—This species of *Quercus* has a cracked fungous bark, and ovate-oblong, bluish, coriaceous, entire or sharply serrated leaves, which are downy beneath. It is a native of northern parts of Africa and of the southern parts of Europe, especially of Spain, Portugal, and

Fig. 286.*



France. It grows to the height of twenty or thirty feet. According to Mohl,¹ the bark of a young branch of *Quercus Suber* consists of four distinct parts: 1st, an exterior layer or *epidermis*; 2dly, colourless cellular tissue, the *epiphlaeum* of Link, the *phlaeum* (φλοιός, the bark of trees) or *peridermis* of Mohl, the *suberous envelop* of some writers; 3dly, green parenchyma, the *mesophlaeum* of Link, the herbaceous or cellular integument of others; 4thly, a fibrous layer called *endophlaeum* or *liber*. Of these four layers, two (namely the 2d and 4th) are useful in pharmacy and medicine.

1. **SUBER; Cork; Cortex exterior Quercus Suberis;** *Exterior Bark of the Cork-Tree.*—The substance known in commerce as *cork* is the *epiphlaeum* or *suberous envelop*, above mentioned. When the branches are from three to five years old, the epidermis cracks by distension, and the second layer enlarges on the inner side by the deposition of new layers. These constitute *cork*.² It falls naturally every eight or nine years, but for commercial purposes is usually removed one or two years before

this period. That season of the year is selected when the bark adheres the most firmly to the wood, in order that the cork may be raised without endangering the separation of the liber from the alburnum. By this precaution, the trees are not at all injured by the corking process; nay, they are said to be more healthy and vigorous than when the cork is allowed to accumulate on their stems. The trees yield these crops from the age of fifteen to one hundred and fifty years.

To remove the cork, an incision is made from the top to the bottom of the tree, and a transverse circular incision at each extremity; the cork is then stripped off. To flatten it, a number of layers are piled up in a pit of water, and loaded with weights to keep them down. Subsequently they are dried, and in that state exported. Our supply is principally derived from Spain and Portugal. To close the transverse pores, cork is charred.

The physical properties of cork are too well known to need description. Its leading character is elasticity. In this respect it is similar to the wood of *Anona palustris*, called *cork wood*, and which is used in Jamaica by the country people, instead of corks, to stop up their jugs and calabashes.³ When thin slices of cork are examined by the microscope, they present a cellular appearance, the cells being four-cornered and tabular.

The most important chemical examinations of cork are those of Chevreul⁴ and Doepping.⁵ According to Chevreul, cork contains traces of a *volatile oil*, *wax* (cerin), *soft resin*, *red and yellow colouring principles*, *tannin*, a *nitrogenous brown substance*, *gallic acid*, *acetic acid*, *calcareous salts*, and *suberin*.

The substance to which the name of *suberin* has been given is the body which remains after cork has been successively treated with alcohol, ether, water, and diluted hydrochloric acid. In its form and physical characters it differs but little from ordinary cork. According to Doepping, it cannot be obtained pure, but always contains *cork cellulose* (C²⁴H⁵O²⁰), some *cork wax* (C²⁵H⁵O³), and a small quantity of a *nitrogenous body*. He found it to consist of carbon 67.5, hydrogen 8.7, nitrogen 2.3, and oxygen 21.12. When cork is treated with nitric acid, the

¹ *Lond. and Edinb. Phil. Mag.* vol. xii. p. 53, 1838.

² See also Dutrochet. *Comptes Rendus*, t. iv. p. 48, Paris, 1838.

³ *The Civil and Natural History of Jamaica*, by P. Brown, M. D. p. 256, Lond. 1769.

⁴ *Ann. Chimie*, t. xvi. p. 155.

⁵ *Annalen d. Chem. u. Pharm.* Bd. xlv. S. 286, 1843; also *The Chemical Gazette*, July 1, 1843.

suberin yields suberic acid ($C^8H^8O^8$), which imparts a peculiar character to cork, and to all barks containing cork.¹

The uses of cork for making floats for fishermen's nets, anchor-buoys, stoppers to vessels (*obtumenta cadorum*), and women's winter shoes, are mentioned by Pliny. On account of the astringent matter which it contains, cork is an improper substance for closing vessels containing chalybeate liquids (especially such as are intended for analysis), as the iron is in part absorbed by the cork.

Cork was formerly employed in medicine. Reduced to powder, it was applied as a styptic: hung about the necks of nurses, it was thought to possess the power of stopping the secretion of milk; lastly, burnt cork, mixed with sugar of lead and lard, has been used as an application to piles.

2. *Cortex Alcornocæ Europææ*; *European Alcornoque*² *Bark*; *Cork-Tree Bark*.—The bark of the cork oak, which I received from Spain under the name of *alcornoque bark*, bears considerable resemblance to oak bark, and was probably obtained from the younger branches of the cork-tree. It is ash-gray externally, and wrinkled or grooved internally. The bark imported from Italy, Spain, and Barbary, under the name of *cork-tree bark*, and which is used by tanners, appears to be the inner bark of older stems. It consists apparently of the third and fourth layers above mentioned. It is in fibrous or stringy pieces, externally rusty red, internally deeply grooved or furrowed. It has very little odour, and an astringent taste. For tanning purposes the Italian bark is considered inferior to the Spanish and Barbary barks. In its medicinal properties, European alcornoque bark resembles oak bark. It owes its astringency to tannic acid. Its powder, in the dose of a drachm, has been used in hemorrhages and diarrhœa.³

3. *Cortex Alcornocæ Americane*; *American Alcornoque Bark*.—This is the genuine alcornoque bark of French and German pharmacologists. The Spanish colonists have applied the name of alcornoque bark to one or more American barks which possess some real or fancied resemblance to the alcornoque bark of their mother-country. Humboldt⁴ says that the *Bowdichia virgiloides* (HBK.) is called by the inhabitants of the districts where it grows, in South America, the alcornoque. In another place,⁵ he states that the same name is given to a *Malpighia* (Byrsonima) on account of the suberous bark of the trunk. Nees von Esenbech⁶ considered *Byrsonima crassifolia* (*Malpighia crassifolia*, Auct.) to be the source of the American alcornoque bark. The bark which comes from South America, and is considered to be genuine alcornoque bark, occurs in large, flat, occasionally arched pieces, having some resemblance to coarse, flat Cinchona bark. The epidermis is usually wanting. Externally the bark is reddish, or dark cinnamon brown; internally it is pale. The taste is slightly bitter. It has been repeatedly subjected to analysis. Biltz⁷ gives as the constituents—*peculiar crystalline matter* (alkornin), 1.15; *matter soluble in alcohol, not in ether* (oxydized tannin?), 1.67; *tannin* with a lime salt, 14.27; *gummy extractive* with starch, a nitrogenous substance, and a supersalt of lime, 33.74; *woody fibre* and *loss*, 47.71; *ashes* of the woody fibre, 1.46=100.0.

American alcornoque bark possesses astringent properties. It was introduced into European practice, in 1811, as a remedy for phthisis, but, after a short trial, it soon fell into disuse; and there are no grounds for supposing that it has any curative powers whatever in this disease.—Dose, in powder, ℥j to ʒj. It may also be used in the form of infusion or decoction (prepared with ʒss of bark and ℥ʒ viij of water), in doses of ℥ʒj or ℥ʒij. The dose of the extract is from gr. x. to ʒj.⁸

ORDER XXVII. ULMACEÆ, *Mirbel*.—ELMWORTS.

CHARACTERS.—*Flowers* hermaphrodite or by abortion unisexual, in loose clusters, never in catkins. *Calyx* membranous, imbricated, campanulate, inferior, irregular. *Petals* 0. *Stamens* definite; inserted into the base of the calyx; erect in æstivation. *Ovary* superior, 1- or 2 celled; *ovules* solitary; pendulous; *stigmas* 2, distinct. *Fruit* 1- or 2 celled, indehiscent, membranous, or drupaceous. *Seed* solitary, pendulous; *albumen* none, or in very small quantity; *embryo* straight or curved, with foliaceous cotyledons; *radicle* superior.—*Trees* or *shrubs*, with rough, alternate, deciduous leaves, and stipules.

PROPERTIES.—The plants of this order bear some analogy to those of Cupuliferæ, in their chemical and medicinal properties. Their bark contains tannic acid; combined, however, with mucilaginous and bitter matters. Hence it is reputed astringent and tonic.

¹ Mulder. *The Chemistry of Vegetable and Animal Physiology*, p. 478, 1849.

² *Alcornoque* is the Spanish name for the cork-oak. It is of Arabic origin, being derived from *dorque*, signifying 'denuded or badly clothed,' adding the article *al*, changing *d* into *c*, and introducing the syllable *no* into the middle of the word. (*Diccionario de la Lengua Castellana, compuesto por la Real Academia Espanola*, 1726-39.)

³ Chomel. *Abrégé de l'Hist. des Plantes usuelles*, t. ii. p. 392, 1761.

⁴ *Nova Genera et Species Plantarum*, t. vi. p. 295.

⁵ *Personal Narrative*, vol. vi. part. i. p. 6.

⁶ Geiger's *Handb. d. Pharm.* 2te Aufl. 2te Abth. p. 1651.

⁷ Brande's *Archiv.* xii.; also L. Gmelin's *Handb. d. Chemie*, Bd. ii. p. 1322.

⁸ For further details respecting alcornoque bark, the reader is referred to a paper by the author in the *Pharmaceutical Journal*, vol. vi. p. 362, 1847.

Dr. M'Dowall, of Virginia, has proposed the bark of *Ulmus fulva* for bougies, tents, catheters, &c.¹

113. ULMUS CAMPESTRIS, Linn.—THE COMMON SMALL-LEAVED ELM.

Sex. Syst. Pentandria, Digynia.

(Cortex interior, L.)

HISTORY.—Dioscorides² speaks of the astringent property of the bark of the elm (*πτελέα*), as does also Pliny.³

BOTANY. Gen. Char.—*Flowers* hermaphrodite. *Calyx* campanulate, 4- to 5-toothed, coloured, persistent. *Stamens* 3 to 6. *Ovary* compressed. *Stigmas* 2. *Fruit* (a samara) suborbicular, with a broad membranous margin (*Bot. Gall.*).

Sp. Char.—*Leaves* doubly serrated, rough. *Flowers* nearly sessile, 4-cleft. *Fruit* oblong, deeply cloven, naked (Sir J. E. Smith).

A large tree, with rugged bark. By the latter character it is readily distinguished from *Ulmus glabra*, which has a smooth, dark, lead-coloured bark.

Hab.—Southern parts of England. Flowers in March or April.

DESCRIPTION.—The official part of the elm is the inner cortical portion, or *liber*. To obtain it, the bark should be separated from the tree in spring; and, after the epidermis and a portion of the external cortex have been removed, the *liber* should be quickly dried.

As met with in the shops, the *inner elm bark* (*cortex ulmi*) consists of thin tough pieces, which are inodorous, and have a brownish-yellow colour, and a mucilaginous, bitter, very slightly astringent taste.

COMPOSITION.—According to Rink,⁴ 100 parts of elm bark contain—*resin* 0.63, *gum* and *mucus* 20.3, *impure gallic acid* (tannin?) 6.5, *oxalate of lime* 6.3 (?), *chloride of sodium* (?) 4.6.

1. **TANNIC ACID.**—Davy⁵ states that 480 grs. of elm bark yielded 13 grs. of tannin.

2. **ULMIC ACID; Ulmin.**—On many trees, especially the elm, there is not unfrequently observed a substance which was supposed to be a morbid production. When dried, it consists of a mucilaginous matter, and carbonate or acetate of potash. By the combined agency of the air and the carbonate, the organic matter is altered in its properties, and is converted into a brown substance, which combines with the potash. This brown matter has been termed *ulmin*, or *ulmic acid*. It may be formed, artificially, by a variety of processes; as by heating a mixture of wood and potash, by the action of sulphuric acid on vegetable matters, and by other methods.

CHEMICAL CHARACTERISTICS.—Infusion of elm bark becomes green (*tannate of iron*) on the addition of a salt of the sesquioxide of iron, and forms a precipitate (*tannate of gelatin*) with a solution of gelatin.

PHYSIOLOGICAL EFFECTS.—The effects of elm bark are those of a mild astringent tonic, containing a considerable quantity of mucilage, which gives it a demulcent property. Hence, in the classification of Richter,⁶ it is arranged as a *mucilaginous astringent*. The decoction, taken in full doses, accelerates the pulse and acts as a diaphoretic and diuretic.

USES.—Lysons⁷ recommended the decoction of this bark in cutaneous eruptions, and Dr. Lettsom⁸ found it successful in ichthyosis. It has now fallen almost into disuse. It has been employed as a cheap substitute for sarsaparilla.⁹

ADMINISTRATION.—Used only in the form of decoction.

DECOCTUM ULMI, L.; Decoction of Elm Bark.—(Fresh Elm Bark, bruised, ʒijss; Distilled Water Oij. Boil down to a pint, and strain.)—Formerly given in skin diseases; now fallen into disuse. Dose, fʒiv to fʒvj three or four times a day.

¹ *Brit. and For. Med. Review*, July 1838, art. *Elm Bark Surgery*, p. 259.

² *Lib. i. cap. 111.*

³ *Geiger, Handb. d. Pharm.*; and Wittstein's *Handwörterbuch*.

⁴ *Phil. Trans.* 1803, p. 233.

⁵ *Medical Transactions*, vol. ii. p. 203.

⁶ *Jeffreys, Cases in Surgery*, Lond. 1820.

⁷ *Hist. Nat. lib. xxiv. cap. 33.*

⁸ *Arzneimitt. Bd. i.*

⁹ *Medical Memoirs*, p. 152.

[ULMUS FULVA, Mich.—SLIPPERY ELM.]

(Slippery Elm Bark, U. S.)

Sp. Char.—*Leaves* very scabrous above, rather unequal, and somewhat cordate at base. *Buds* clothed with a fulvous tomentum. *Flowers* in dense sub-sessile fascicles. *Samara* orbicular, naked on the margin. (*Beck. Bot.*)

This tree is sometimes called also Red Elm. It is from 20 to 40 feet high, with rugate branches. The leaves are from 4 to 6 inches long, and 2 or 3 inches broad, lanceolate oval, or obovate oblong, conspicuously acuminate, doubly serrate, the upper surface scabrous, beneath tomentose pubescent, especially along the nerves and midrib, petioles about one-third of an inch long, pubescent. *Stipules* pilose. *Flowers* on short pedicels, numerous, in dense lateral clusters. *Calyx* about 7 cleft; segments obtuse, clothed and ciliate, with a reddish tawny pubescence. *Stamens* often 7, much exserted; anthers dark-purple. *Styles* granular pubescent, purple. *Samara* orbicular, about half an inch in diameter, radiately veined, pubescent in the centre, on a slender pedicel as long as the calyx; margin smooth, cleft at apex between the styles; segments acuminate by the pubescent adnate styles, and so incurved and over-lapped as to give the margin the appearance of being entire at apex. (*Darlington.*)

This plant is common in the United States, growing in low grounds and along fences.

The inner bark is fibrous, and is removed from the trunk and large branches of the tree in long pieces. It is found in the shops in this form or ground into powder. It is bland and demulcent, and is used as a substitute for flaxseed and other demulcent articles. From the powder can be made an excellent poultice by mixing with the requisite quantity of hot water.

INFUSUM ULMI, U. S.; *Infusion of Slippery Elm Bark.*—Made by macerating an ounce of Slippery Elm Bark in a pint of boiling water. Used for the ordinary purposes of a demulcent solution.

ORDER XXVIII. URTICACEÆ, Endl.—NETTLEWORTS.

URTICÆ, Jussieu.

CHARACTERS.—*Flowers* herbaceous, inconspicuous, polygamous. *Calyx* membranous, lobed, persistent. *Stamens* definite, distinct, inserted in the base of the calyx, and opposite its lobes. *Ovary* superior, simple. *Ovule* solitary, erect. *Fruit* a simple, indehiscent nut, naked or surrounded by the persistent calyx. *Embryo* straight, with fleshy albumen; cotyledons flat; radicle superior—*Trees, shrubs, or herbs.* *Leaves* frequently covered with asperities or stinging hairs. *Stipules* mostly persistent, rarely deciduous or absent.

PROPERTIES.—The order is now very circumscribed; and contains but few properties interesting to the physician. The most remarkable property of the order is the acridity (sometimes very extreme) of the liquid contained in the epidermoid gland at the base of the stinging hair. Endlicher¹ says that it is bicarbonate of ammonia; but this is an obvious error, as ammonia, in any known form, is incompetent to produce the violent effect ascribed to some of the East Indian Urticaceæ.

Urtication, or flagellation by a bunch of nettles (*Urtica dioica*), is an old method of treating palsy².

114. Parietaria officinalis, Linn.—Common Wall-Pellitory.

Sez. Syst. Tetrandria, Monogynia.

(II. rba.)

This is a common indigenous plant, which was formerly in great repute as a diuretic and lithontriptic. By some practitioners it is still highly esteemed. It is used in calculous and other urinary affections, and also in dropsies. The *expressed juice* may be taken in doses of one or two fluidounces. Or the *decotion* (prepared by boiling 3j of the herb in a pint of water) may be substituted. The *extract* has also been used. On account of a nitrate which the plant contains, the extract is said to have taken fire in making it.³

¹ *Enchiridion Botanicon.*² Withering, *Arrangement of British Plants*, 7th edit. vol. ii. p. 237.³ Celsus, lib. iii. cap. 27.

ORDER XXIX. CANNABINACEÆ, *Lindl.*—HEMPWORTS.CANNABINEÆ, *Endl.*

CHARACTERS—*Flowers* diœcious. **MALES**: in racemes or panicles. *Calyx* herbaceous, scaly, imbricated. *Stamens* 5, opposite the sepals; *filaments* filiform; *anthers* terminal, 2-celled, opening longitudinally. **FEMALES**: in spikes or cones. *Sepal* 1, enwrapping the ovary. *Ovary* free, 1-celled. *Ovule* solitary, pendulous. *Stigmas* 2, subulate. *Fruit* 1-celled, indehiscent. *Embryo* without albumen, hooked, or spirally coiled, radicle superior, lying against the back of the cotyledon.

PROPERTIES—There are only two species in this family, and each of these will be separately noticed. One of these (*Cannabis sativa*) is remarkable for the tenacity of its fibre, and the narcotic intoxicating quality of its juices: the other (*Humulus Lupulus*), for its bitter principle, and its fragrant oil, whose vapor is soporific.

115. CANNABIS SATIVA.—COMMON HEMP.

Sex. Syst. Diœcia, Pentandria.

(Herba et Resina. The Extract, D.)

HISTORY.—This plant was well known to the ancient Greeks and Romans, but they do not appear to have been acquainted with its narcotic properties. Dioscorides¹ merely mentions that the expressed juice of the seeds of *κάρναβις* allays earache, and the same statement is made by Galen.² Herodotus³ mentions it, and states that the Scythians cultivated it and made themselves garments of it. He also adds that they threw the seeds on red-hot stones, and used the perfumed vapour thereby obtained as a bath, which excited from them cries of exultation. This I presume refers to the intoxicating properties of its smoke. The hemp may have been, as Dr. Royle⁴ suggests, the “assuager of grief” or the *nepenthes* (*νιπενθής*) of which Homer⁵ speaks as having been given by Helen to Telemachus in the house of Menelaus. Helen is stated to have received the plant from a woman of Egyptian Thebes. It is known in India, as the “increaser of pleasure,” the “exciter of desire,” the “cement of friendship,” the “causer of a reeling gait,” the “laughter mover,” &c.⁶

Pliny⁷ mentions it under the name of *Cannabis*.

BOTANY. Gen. Char.—*Flowers* diœcious. **MALES**: *Flowers* racemose. *Calyx* 5-parted, imbricated. *Stamens* 5. **FEMALES**: *Flowers* in spikes. *Calyx* (bract?) 1-leaved, acuminate, rolled round the ovary. *Ovary* roundish. *Style* short. *Stigmas* 2, filiform, pubescent. *Fruit* 1-celled, 2-valved.

Sp. Char.—The only species.

Annual. Stem 3 to 5 or 6 feet high, erect, branched, angular. Leaves on long weak petioles, digitate, serrated, roughish. Stipules subulate. Flowers in clusters, axillary. The whole plant has a clammy feel.

CANNABIS SATIVA, var. *INDICA*; *Indian Hemp*.—The plant which grows in India, and has been described by some botanists⁸ under the name of *Cannabis indica* or *Indian Hemp*,⁹ does not appear to possess any specific differences from the common hemp. Roxburgh¹⁰ and most other distinguished botanists have accordingly considered it identical with the *Cannabis sativa* of

¹ Lib. iii. cap. 165. The *κάρναβις ἀργεία* of this author (lib. iii. cap. 166) is the *Althœa canabina* of modern botanists.

² *De Simpl. Med. Facult.* lib. vii. cap. 5.

³ Lib. iv. *Melpomene*. lxxiv. and lxxv.

⁴ *Illustrations of the Botany of the Himalayan Mountains*, p. 334.

⁵ *Odyssey*, iv. 220.

⁶ Royle, *op. supra cit.*; also, Dr. O'Shaughnessy, *On the Preparation of the Indian Hemp or Gunjah*, Calcutta, 1839.

⁷ *Hist. Nat.* lib. xix. cap. 56; and lib. xx. cap. 97.

⁸ Rumphius, *Herbarium Amboinense*, vol. v. t. 77.

⁹ In the United States of America, the denomination of *Indian hemp* is applied, both in the Pharmacopœia and Dispensatory, to the *Apocynum cannabinum*; and it has been imported and sold in London for the real Indian hemp (*Cannabis sativa*, var. *Indica*), according to the statement of Dr. Fred. J. Farre (*Lond. Med. Gaz.* May 5, 1843, p. 209).

¹⁰ *Flora Indica*, vol. iii. p. 772.

Linnaeus and Willdenow. *C. indica* branches from the ground up to within two feet of the top; whereas common hemp grows three or four feet before it branches.* The fruit also of *C. indica* is smaller and rounder. I have carefully compared *C. indica* (both that grown in the Chelsea Garden and that contained in Dr. Wallich's Herbarium in the possession of the Linnean Society) with the *C. sativa* in Linnaeus's collection, and I cannot discover any essential distinction between them. The male plant appears to me to be in every respect the same.† In the female plants, the flowers of *C. indica* were more crowded than those of common hemp.

Hab.—Persia, Caucasus, hills in the north of India. Cultivated in various other countries.

DESCRIPTION.—The parts employed in Asia for the purposes of intoxication, and in Europe for medicine, are the herb (leaves) and the resin.

1. *Herba Cannabis sativæ*.—This is used in India in two forms; one called *gunjah*, the other *bang*. The *hashish* of the Arabs differs somewhat from *gunjah*.

a. *Gunjah*.—This is the dried hemp plant which has flowered, and from which the resin has not been removed. It is sold in the Calcutta bazaars, for smoking chiefly, in bundles of about two feet long and three inches in diameter, each containing twenty-four plants. That which I have received from Dr. O'Shaughnessy, and also found in commerce, consists of cylindrical or fusiform masses (about the size and shape of the fingers) of a grayish or greenish-brown colour, and composed of stems, leaves, and petioles pressed together. It has a faint odour and feeble bitterish taste. In commerce it is known by the name of *guaza* or *guazah*.

β. *Bang*, *Subjee*, or *Sidhee*.—This consists of the larger leaves and capsules without the stalks. I have not met with this in commerce.

γ. *Háshish* or *Hashish*.—This, according to Steeze,² consists of the tops and tender parts of the plant collected after inflorescence.

2. *Resina Cannabis sativæ*.—The concreted resinous exudation from the leaves, slender stems, and flowers, is called *Churrus*. The mode of collecting it is somewhat analogous to that adopted in Crete for the collection of ladanum. In "Central India and the Saugor territory, and in Nipal, Churrus is collected during the hot season in the following singular manner: Men clad in leathern dresses run through the hemp fields, brushing through the plant with all possible violence; the soft resin adheres to the leather, and is subsequently scraped off and kneaded into balls, which sell from five to six rupees the seer. A still finer kind—the *Momeea* or *waren Churrus*—is collected by the hand in Nipal, and sells for nearly double the price of the ordinary kind. In Nipal, Dr. M'Kinnon informs me, the leathern attire is dispensed with, and the resin is gathered on the skin of the naked coolies. In Persia, it is stated by Mirza Abdul Razes that the Churrus is prepared by pressing the resinous plant on coarse cloths, and then scraping it from these and melting it in a pot with a little warm water. He considers the Churrus of Herat as the best and most powerful of all the varieties of the drug."³ I have a specimen of spurious Churrus.

Churrus, such as I have received it from Dr. O'Shaughnessy, is in masses having the shape and size of a hen's egg, or of a small lemon, and formed by the adhesion of superimposed elongated pieces. It has a dull grayish-brown colour, and not much odour. It consists of resinous and various foreign matters (fragments of flowers, leaves, seeds, &c.)

3. *Fructus Cannabis sativæ*.—The fruits, called usually *hempseed* (*semen can-*

Fig. 287.

*Cannabis sativa.*

* This agrees with a remark in the *Hortus Cliffortianus*: "Quod mas in Horto Malabarico exhibitus nostra sit planta nullum dubium detur; femina autem parum recedit foliis ternatis, tamen et ejusmodi plantas in sole macero apud nos observamus non infrequenter."

² *Pharmaceutical Journal*, vol. v. p. 63, 1845.

³ O'Shaughnessy, *op. supra cit.* p. 6.

The singular form of insanity said to be brought on by it has already (see vol. i. p. 237) been noticed.

It acts as an *anæsthetic* (see vol. i. p. 238). It relieves pain, and is, therefore, employed as an *anodyne* or *paregoric*. Moreover, Mr. Donovan¹ found that under its influence his sense of touch and feeling gradually became obtuse, until at length he lost all feeling unless he pinched himself severely; and Dr. Christison² states he felt a pleasant numbness of his limbs after its use.

Its influence as a *cinetic* (see vol. i. p. 240) or agent affecting the action of the muscles, is remarkable. It relieves spasm, and is, therefore, frequently used as an *antispasmodic*. On Orientals large doses produce a cataleptic condition (in which the muscles are moderately contracted, but flexible and pliant, and the limbs retain any position or attitude in which they may be placed).

The following illustrative cases are taken from Dr. O'Shaughnessy's paper on Indian hemp:—

At two P. M. a grain of the resin of hemp was given to a rheumatic patient. At four P. M. he was very talkative, sang, called loudly for an extra supply of food, and declared himself in perfect health. At six P. M. he was asleep. At eight P. M. he was found insensible, but breathing with perfect regularity, his pulse and skin natural, and the pupils freely contractile on the approach of light. Happening by chance to lift up the patient's arm, the "professional reader will judge of my astonishment," observes Dr. O'Shaughnessy, "when I found that it remained in the posture in which I placed it. It required but a very brief examination of the limbs to find that the patient had by the influence of this narcotic been thrown into that strange and most extraordinary of all nervous conditions, into that state which so few have seen, and the existence of which so many still discredit—the genuine *cataplexy* of the nosologist. We raised him to a sitting posture, and placed his arms and limbs in every imaginable attitude. A waxen figure could not be more pliant or more stationary in each position, no matter how contrary to the natural influence of gravity on the part. To all impressions he was meanwhile almost insensible." He continued in this state till one A. M., when consciousness and voluntary motion quickly returned.

Another patient who had taken the same dose fell asleep, but was aroused by the noise in the ward. He seemed vastly amused at the strange aspects of the statue-like attitudes in which the first patient had been placed. "On a sudden he uttered a loud peal of laughter, and exclaimed that four spirits were springing with his bed into the air. In vain we attempted to pacify him; his laughter became momentarily more and more uncontrollable. We now observed that the limbs were rather rigid, and in a few minutes more his arms and legs could be bent, and would remain in any desired position. He was moved to a separate room, where he soon became tranquil, his limbs in less than an hour gained their natural condition, and in two hours he expressed himself perfectly well and excessively hungry."

On Europeans I have never heard of a cataleptic state being produced by this drug. In a case of tetanus under my care in the London Hospital, and which was carefully watched by Dr. O'Shaughnessy and myself, the resinous extract of Indian Hemp was given in increasing doses up to twenty grains. It caused stupor and cessation of spasms; but no perfect cataleptic state. The only tendency to this condition which was observed was when the arm of the patient was lifted and then cautiously let go: it fell slowly and gradually, not quickly, as it would have done under ordinary conditions: the patient was at this time quite insensible.

By internal use it acts as a *mydriatic* (see vol. i. p. 246), causing preternatural dilatation of the pupil. But Dr. Lawrie³ states that when applied around the eye it does not cause dilatation of the pupil.

Indian hemp does not appear much to affect the secretions. It neither excites nausea nor lessens the appetite. It neither causes dryness of the tongue nor constipation of the bowels. It does not appear to check or otherwise affect the bronchial secretions. I am disposed to think that it is somewhat sudorific. Drs. Ballard and Garrod⁴ state that in large doses it communicates an odour to the urine like that evolved when the tincture is mixed with water, and in part like that of the Tonquin bean.

Compared with opium, Indian hemp differs in its operation on the system in several remarkable circumstances: as by its inebriating, phantasmatic, and aphrodisiac effects; by its causing cataplexy and dilatation of pupil; and by its not

¹ *Dublin Journal of Medical Science*, Jan. 1845.

² *Lond. and Edinb. Monthly Journal of Medical Science*, Nov. 1844, p. 947.

³ *Elements of Materia Medica*.

⁴ *Dispensatory*

causing nausea, loss of appetite, dry tongue, constipation, or diminution of the secretions.

Dr. Hooke, in his account of Indian hemp (Bangué) read to the Royal Society, Dec. 18, 1659, notices the various odd tricks shown by persons while in the ecstasy caused by this plant; and adds that, when this condition subsides, the patient finds himself mightily refreshed and exceedingly hungry.

The general effects of Indian hemp on man, as stated by Dr. O'Shaughnessy, from his own observations, are alleviation of pain (mostly), remarkable increase of appetite, unequivocal aphrodisia, and great mental cheerfulness. Its more violent effects were delirium of a peculiar kind, and a cataleptic state.

Its effects on animals were analogous: he gave ten grains of Nipalese Churru dissolved in spirit to a middling-sized dog: "In half an hour he became stupid and sleepy, dozing at intervals, starting up, wagging his tail as if extremely contented; he ate some food greedily, on being called to he staggered to and fro, and his face assumed a look of utter and helpless drunkenness. These symptoms lasted about two hours, and then gradually passed away; in six hours he was perfectly well and lively."

It would appear that Indian hemp acts more powerfully in India than in Europe. My experiments (detailed in the 2d edition of this work, pp. 1097-8) fully bear out this statement. Dr. O'Shaughnessy, when in England, satisfied himself of the difference of the effect of Indian hemp in this country and in Bengal; and he observes,¹ that while in India he had seen marked effects from half a grain of the extract, or even less, and had been accustomed to consider one grain and a half a large dose, in England he had given ten or twelve or more grains to produce the desired effect.

USES.—Indian hemp is chiefly employed as a medicine, for its hypnotic, anodyne, and antispasmodic properties; occasionally, also, for its mental influence (*i. e.* as a phrenic and nervine). Compared with opium, it is less certain than the latter agent; over which, however, it has several advantages. Thus it does not constipate the bowels, lessen the appetite or create nausea, produce dryness of the tongue, or check the pulmonary secretion, as opium is well known to do. Moreover, in some patients in whom opium causes headache, and various distressing feelings, Indian hemp occasionally acts without any of these inconveniences; but I have heard others object to its continuance on the ground of its very unpleasant effects.

As a *hypnotic*, I have used it with advantage in spirit-drinkers, and have succeeded in one or two cases in producing sleep with it where large doses of morphia had failed. In some hysterical patients, and in cases of chorea, I have occasionally employed it to induce sleep, where the use of opium was from some cause objectionable. Dr. Clendinning² speaks favourably of its soporific influence in pulmonary affections and low fever. It has the great advantage over opium of neither repressing the secretions nor lessening the appetite for food.

As an *anodyne*, it is, I think, in general, decidedly inferior to opium; but there are occasions where its use is to be preferred to the latter agent. In acute and subacute rheumatism, in gout, and in neuralgia, it frequently alleviates the pain.

As an *antispasmodic*, it has been employed in tetanus, hydrophobia, malignant cholera, chorea, and infantile convulsions. In the cases of tetanus (both traumatic and idiopathic) and of hydrophobia which I have seen treated with it, it completely failed to give permanent relief. In one case of traumatic tetanus, it alleviated the pain and spasms, but the patient notwithstanding died. In a case under the care of Professor Miller,³ it was given, and the patient recovered. It has failed, however, in the hands of Mr. Potter⁴ and others. And in a case of idiopathic tetanus in Guy's Hospital, under the care of Dr. Babington,⁵ it proved useless. In chorea, I have found it serviceable, sometimes as an antispasmodic, at others as a hypnotic; and the same may be said of its use in hysteria.

As a *phrenic* or medicinal agent affecting the mental functions, Indian hemp has also been employed. Dr. Clendinning speaks favourably of its use as a nervine stimulant, in removing languor and anxiety, and raising the pulse and spirits; and

¹ *Pharmaceutical Journal*, vol. ii. p. 594, 1843.

² *Lond. and Edinb. Monthly Journal of Medical Science*, Jan. 1845.

³ *Lancet*, vol. i. p. 36, Jan. 11, 1845.

⁴ *Medico-Chirurg. Transactions*, vol. xvi.

⁵ *Ibid.* vol. ii. p. 351, Dec. 14, 1844.

Dr. Conolly thinks that it may be useful in some chronic forms of mania.¹ Dr. Sutherland has not obtained any good effect from it.²

ADMINISTRATION.—In England, Indian hemp is usually administered in the form of resinous or alcoholic extract and of tincture.

1. *EXTRACTUM CANNABIS INDICÆ ALCOHOLICUM*; *Resinous or Alcoholic Extract of Indian Hemp*.—This is the preparation usually sold in the shops under the name of *resin of Indian hemp* or *cannabin* (see *ante*, p. 336). Dr. O'Shaughnessy directs it to be prepared by boiling the rich adhesive tops of the dried gunjah in rectified spirits until all the resin is dissolved. "The tincture thus obtained is evaporated to dryness in a vessel placed over a pot of boiling water. The extract softens at a gentle heat, and can be made into pills without any addition." Mr. Robertson,³ of Calcutta, prepared it by a kind of percolation process; the vapour of alcohol being transmitted through the dry herb. At first a thin tarry matter containing much resin, latterly a brown liquor containing little resin but much extractive passed over. At this point, water was substituted for the spirit in the still, and as much as possible of the spirit retained by the plant thus expelled from it. Part of the alcohol was removed from the fluid by distillation; but the rest was dissipated by evaporation at a temperature not exceeding 150° F. From 1 cwt. of the plant about 8 lbs. of extract were obtained at one operation, which was so slowly conducted as in all its stages to last a fortnight.

The following is the process given by the Messrs. Smith, of Edinburgh,⁴ for the preparation of this extract: Digest bruised gunjah in successive quantities of warm water till the expressed water comes away colourless; and again for two days, at a moderate heat, in a solution of carbonate of soda, in the proportion of one part of the salt to two of gunjah. Colouring matter, chlorophylle, and inert concrete oil being thus removed, express and wash the residuum, dry it, and exhaust it by percolation with rectified spirit. Agitate with the tincture, milk of lime containing an ounce of lime for every pound of gunjah, and, after filtration, throw down the excess of lime by a little sulphuric acid. Agitate with the filtered liquor a little animal charcoal, which is afterwards to be removed by filtration. Distil off most of the spirit, add to the residual tincture twice its weight of water in a porcelain basin, and let the remaining spirit evaporate gradually. Lastly, wash the resin with fresh water till it comes away neither acid nor bitter, and dry the resin in thin layers. This resin contains the peculiar taste and odour of the gunjah. A temperature of 180° F. acting for eight hours on thin layers of it exposed to the air does not impair its activity. 100 lbs. of dry gunjah yield about 6 or 7 lbs. of this extract.

The *Dublin College* directs the *Extractum Cannabis Indicæ purificatum* to be prepared as follows:—

Take of Extract of Indian Hemp of Commerce $\bar{3}$ j; Rectified Spirit $f\bar{3}$ iv. Dissolve the extract in the spirit, and when the dregs have subsided, decant the clear liquid, and evaporate, by means of a water-bath, to the consistence of a soft extract.

The dose of the alcoholic extract of Indian hemp is usually from gr. j to grs. v. I have usually found one grain of the extract kept in the London shops to act as a narcotic. The Messrs. Smith state that two-thirds of a grain of the pure resin produced on themselves and others powerful narcotic effects. In a case of tetanus under my care in the London Hospital, the dose of the extract (supplied by Dr. O'Shaughnessy, who watched the case with me) was gradually increased to grs. xx. It may

Fig. 288.



Apparatus for the percolation of alcohol vapour through the dried herb of Indian hemp.

- a. The still, charged with strong spirits.
- b. The cask, containing the plant, and into the side of which the nose of the still was introduced.
- c. Common condensing worm.

¹ See also Moreau, *Du Haschisch et de l'Aliénation Mentale, Etudes Psychologiques*, Paris, 1845.

² Further Report of the Commissioners in Lunacy, p. 392, 1817.

³ *Pharmaceutical Journal*, vol. vi. p. 71, 1816.

⁴ *Ibid.* p. 171, 1846

be administered in the form of pill; or better by diffusion through an emulsion (prepared by rubbing the extract with olive oil, in a warm mortar, and gradually adding mucilage, and afterwards water), or by solution in rectified spirit, and dropping the tincture into water immediately before its administration.

2. *TINCTURA CANNABIS INDICÆ*, D.; *Tincture of Indian Hemp*.—(Purified Extract of Indian Hemp 3ss; Rectified Spirit Oss. Dissolve the extract in the spirit, D.)—These are the proportions directed to be used by Dr. O'Shaughnessy; but, probably by a typographical error, he has ordered *proof* spirit instead of rectified spirit. Dose from ℥x to ʒj. Dr. O'Shaughnessy gives in tetanus ʒj every half hour, until the paroxysms cease, or catalepsy is induced; in cholera, ten drops every half hour. It may be administered in an emulsion or mucilaginous mixture, or in water sweetened with sugar. It should be swallowed soon after it has been added to the aqueous liquid, as the resin precipitates, and is apt to adhere to the side of the vessel.

OTHER PREPARATIONS OF INDIAN HEMP.—By the Asiatics, Egyptians, and others who employ Indian hemp for the purposes of intoxication, various preparations of this drug are in use. In some of these the plant itself is employed, either rubbed up with water and made into a draught or formed into an electuary. But a favourite mode of using it is to extract the active principle by some fatty matter (generally butter or oil), by which an oleaginous solution or fatty extract is obtained. For this purpose the hemp is boiled in butter or oil, with a little water, usually until the water is boiled away. It is said that the fatty extract thus obtained will preserve its intoxicating powers for years. It is usually mixed up with other ingredients, and taken in the form of an electuary, confection, or pastile. The *majoon* used at Calcutta,¹ the *mpouchari* employed at Cairo,² and the *dawamesc* of the Arabs,³ are preparations of this kind. Lastly, hemp is also used for smoking in pipes.

ANTIDOTES.—In a case of poisoning by Indian hemp the treatment should be the same as that for poisoning by opium (which see).

116. HUMULUS LUPULUS, Linn.—THE COMMON HOP.

Sex. Syst. Diœcia, Pentandria.

(Amentum, L.—Catkin, E.—The dried strobiles. Lupulina; the yellow powder separated from the strobiles by rubbing and sifting, D.)

HISTORY.—This plant is probably the *Lupus salictarius* of Pliny.⁴ Its culture was introduced into this country from Flanders, in the reign of Henry VIII.⁵

BOTANY. *Gen. Char.*—*Diœcious*. MALES:—*Calyx* 5-partite. *Stamens* 5. FEMALES:—*Strobiles* consisting of large, persistent, concave scales [bracts], having a single flower in the axilla of each. *Ovary* 1. *Styles* 2. *Seed* 1, with an arillus. *Embryo* spirally contorted (*Bot. Gall.*).

Sp. Char.—The only species.

Perennial. *Stems* annual, long, weak, and climbing, scabrous. *Leaves* petiolate, 3- to 5-lobed, serrated, veiny, rough. *Flowers* greenish yellow.

Hab.—Thickets and hedges in many parts of Europe. Indigenous [?]. Flowers in July.

CULTIVATION.—The female plant is cultivated in several counties in England, especially Kent, Sussex, Surrey, Worcestershire, and Herefordshire. The third year after planting it generally comes into full bearing. *Stacking* or *setting* the *poles* is performed in April or May. The *gathering* or *picking* takes place in September. The cones are dried in kilns, and are then packed in hempen sacks, called *bags* or *pockets*. This operation is called *bagging*.⁶

DESCRIPTION.—The aggregate fruits of the *Humulus Lupulus* are strobiles or catkins (*strobili seu amenta lupuli*), in commerce termed *hops*. They consist of scales, nuts, and lupulinic glands or grains. The *scales* are the enlarged and persistent bracts, which enclose the nuts: they are ovate, membranous, and at their

¹ O'Shaughnessy, *op. supra cit.*

² Buchner's *Repertorium*, 2te Reihe, Bd. xlix. S. 359, 1848; also 3tte Reihe, Bd. i. S. 94, 1848.

³ Moreau, *op. supra cit.*

⁴ *Hist. Nat. lib. xxi. cap. 50*, ed. Valp.

⁵ Loudon's *Encyclopædia of Agriculture*.

⁶ Beckmann, *Hist. of Invent.* vol. iv. p. 340.

base glandular. The *nuts* (achenia) are small, hard, nearly globular, and covered with aromatic, superficial, globose glands. The *lupulinic glands* or *grains* (commonly termed *yellow powder* or *lupulin*) are the most important parts of the strobiles. By thrashing, rubbing, and sifting, Dr. Ives¹ procured 14 ounces from six pounds of hops; and he therefore concluded that dry hops would yield about a sixth part of their weight of these grains. They are usually intermixed with sand. They are rounded, of a cellular texture, golden yellow, and somewhat transparent. They are sessile, or nearly so. The common centre, around which the cells are arranged, has been called the *hilum*. By drying they lose

Fig. 290.



Dried Lupulinic grain, with its hilum
(magnified).

their spherical form. Placed in water they give out an immense number of minute globules. Under other circumstances they become ruptured, and allow an inner envelop to escape. Ac-

cording to Turpin,² they consist of *two vesicles*, one enclosing the other. The inner one contains *globules, an aromatic oil, and a gas*. He also states that, in the bubbles of the disengaged gas, an immense number of crystals are formed.

COMPOSITION.—Payen, (Chevallier, and Pelletan³ analyzed the scales and lupulinic grains. Dr. Ives⁴ also examined the latter.



Humulus Lupulus.

a. Male flower. b. Female do. c. Sepal or bracteole.
d. Bract. e. Embryo. f. Lupulinic gland.

LUPULINIC GRAINS.		SCALES.	
<i>Payen, Chevallier, and Pelletan's Analysis.</i>		<i>Payen, Chevallier, and Pelletan's Analysis.</i>	
Volatile oil	2.00	Tannin	4.16
Bitter principle (Lupulite)	10.30	Extractive	8.33
Resin	50 to 55.00	Bitter principle	9.16
Lignin	32.00	Wax	10.00
Fatty, astringent, and gummy matters, osmazome, malic and carbonic acids, several salts (malate of lime, acetate of ammonia, chloride of potassium, sulphate of potash), &c.	traces.	Resin	30.00
		Lignin	38.33
	99.30		100.00

¹ *Journal of Science*, vol. xi. p. 205.

² *Mémoires de l'Acad. Royale des Sciences*, t. xvii. p. 104, 1840; see also Raspail, *Chim. Org.*

³ *Journ. de Pharm.* t. viii. p. 209; and *Journ. de Chim. Méd.* t. ii. p. 527.

⁴ *Journal of Science*, vol. xi. p. 205.

1. **VOLATILE OIL OF HOPS.**—Resides in the lupulinic grains. Obtained by submitting these, or hops which contain them, to distillation with water. Its colour is yellowish, its odour that of hops, its taste acrid. It is soluble in water, but still more so in alcohol and ether. Its sp. gr. is 0.910. By keeping, it becomes resinified. It is said to act on the system as a narcotic. The water which comes over, in distillation, with the oil, contains acetate of ammonia, and blackens silver: from which circumstance the presence of sulphur is inferred.

2. **BITTER PRINCIPLE OF HOPS; Lupulite.**—It is procured by treating the aqueous extract of the lupulinic grains, united with a little lime, with alcohol. The alcoholic tincture is to be evaporated to dryness, the residue treated with water, and the solution evaporated. The residue, when washed with ether, is lupulite. It is uncrystallizable, yellowish white, very bitter, soluble in 20 parts of water, very soluble in alcohol, and slightly so in ether. The aqueous solution froths by agitation; it forms no precipitate with either tincture of nutgalls or acetate of lead. Lupulite contains no nitrogen. It is devoid of the narcotic property of the oil. In small doses it is said to have caused loss of appetite and diminished digestive power; but a repetition of the experiment is very desirable.

3. **TANNIC ACID; Tannin.**—In the manufacture of beer, this principle serves to precipitate the nitrogenized or albuminous matter of the barley, and, therefore, for clarification.

4. **RESIN.**—Is of a golden yellow colour, and becomes orange-yellow by exposure to the air. It is soluble in both alcohol and ether. It appears to be the oil changed into resin, partly by oxidizement.

CHEMICAL CHARACTERISTICS.—A decoction of hops reddens litmus, owing to the presence of free acid. Sesquichloride of iron strikes an olive green colour (*tannate of iron*). A solution of gelatin renders the filtered decoction turbid (*tannate of gelatin*). Chloride of barium occasions with it a white precipitate (*sulphate of baryta*). Oxalate of ammonia also causes a white precipitate (*oxalate of lime*).

PHYSIOLOGICAL EFFECTS.—The odorous emanations (vapour of the volatile oil) of hops possess narcotic properties. Hence a pillow of these cones promotes sleep, as I have several times witnessed. Moreover, we are told that stupor has occasionally been induced in persons who have remained for a considerable time in hop warehouses.

The lupulinic grains are aromatic and tonic. They appear also to possess soothing, tranquillizing, and, in a slight degree, sedative and soporific properties. But the existence of any narcotic quality has been strongly denied by Dr. Bigsby,¹ Magendie,² and others. "I have tried, at different times," says Magendie, "both the lupuline [lupulinic grains] in substance, and its different preparations, on animals, but I have never observed that it is a narcotic, although this property is one which is most strikingly displayed in experiments on animals." Dr. Maton³ found that it allayed pain, produced sleep, and reduced the frequency of the pulse from 96 to 60 in twenty-four hours.

Both infusion and tincture of hops are mild but agreeable aromatic tonics. They sometimes prove diuretic, or, when the skin is kept warm, sudorific. Their sedative, soporific, and anodyne properties are very uncertain.

USES.—A pillow of hops (*cervicale seu pulvinus, pulvinar lupuli*) is occasionally employed in mania, and other cases in which inquietude and restlessness prevail, and in which the use of opium is considered objectionable. In hop countries it is a popular remedy for want of sleep. The benefit said to have been obtained from it by George III., for whom it was prescribed by Dr. Willis, in 1787, brought it into more general use.

Hops are given internally to relieve restlessness consequent upon exhaustion and fatigue, and to induce sleep in the watchfulness of mania and of other maladies; to calm nervous irritation; and to relieve pain in gout, arthritic rheumatism, and after accouchement. Though they sometimes produce the desired effect, they frequently fail to give relief. Dr. Maton used it, with good effect, as an anodyne in rheumatism.

As a tonic, it is applicable in dyspepsia, cachectic conditions of the system, or any other maladies characterized by debility.

Hops have been applied, topically, in the form of fomentation or poultice, as a

¹ *Lond. Med. Rep.* vol. iv. p. 287.

² *Observations on Humulus Lupulus*, by A. Freake, 2d edit.

³ *Formulaire.*

resolvent or discutient, in painful swellings and tumours. Freake employed an ointment, composed of lard and the powder of the hop, as an anodyne application to cancerous sores.¹

But the principal consumption of hops is in the manufacture of beer and ale, to which they communicate a pleasant, bitter, and aromatic flavour, and tonic properties; while, by their chemical influence, they check the acetous fermentation. Part of the soporific quality of beer and ale is usually ascribed to the hops used in the manufacture of these beverages.

ADMINISTRATION.—The best preparation of hops, for internal use, is the yellow powder (*lupulinic grains* or *lupulin*). The *infusion* and *tincture* are less eligible modes of exhibition. The *extract* is still more objectionable. *Well-hopped-beer* is a convenient mode of administering hops, when fermented liquors are not contra-indicated (see *ante*, p. 118).

1. INFUSUM LUPULI, L.; *Infusion of Hops*.—(Hops ʒvj; Boiling Distilled Water Oj [Hops ʒss; Boiling Water Oj, U. S.]. Macerate for four [two, U. S.] hours in a vessel lightly covered, and strain.)—Dose, fʒj to fʒij.

2. TINCTURA LUPULI, L. [U. S.]; *Tinctura Humuli*; *Tincture of Hops*.—(Hops ʒvj [ʒv, U. S.]; Proof Spirit Oij. Macerate for seven days, and strain.)—Dose, fʒss to fʒij.

3. EXTRACTUM LUPULI, L. E.; *Extractum Humuli*, D.; *Extract of Hops*.—(Hops lbjss [lbj, E.]; Boiling Distilled Water Cong. ij [Cong. j, E.]. Macerate for twenty-four hours, then boil down to a gallon [Oiv, E.], and strain the liquor while hot; lastly, evaporate [in the vapour bath, E.] to a proper consistence. The directions of the Dublin College are nearly the same as those of the Edinburgh College.)—Dose, grs. v to ʒj. Whatever virtue this preparation possesses is owing to the bitter principle or lupulite.

4. LUPULINA; *Yellow Powder*; *Lupulinic Grains* or *Glands*.—(Separated from the strobiles by rubbing and sifting.)—Dose, grs. vj to grs. xij, taken in the form of powder or pills.

5. TINCTURA LUPULINÆ, D.; *Tinctura Lupuli*, E.—(Lupulin ʒv; Rectified Spirit Oij. Macerate for fourteen days, strain, express, and filter, D.—Take any convenient quantity of Hops, recently dried; separate by friction and sifting the yellowish-brown powder attached to the scales. Then take of this powder ʒv [ʒiv, U. S.]; and of Rectified Spirit Oij; and prepare the tincture by percolation or digestion, as directed for tincture of capsicum. *Ph. Ed.*)—Dose, ʒss to ʒij.

ORDER XXX. MORACEÆ.

MORACE, *Endlicher*.

CHARACTERS.—*Flowers* unisexual. MALES:—*Calyx* 0, or 3—4-parted. *Stamens* 3—4, inserted into the base of the calyx and opposite its segments. FEMALES:—*Calyx* 0, or 4—5-parted. *Ovary* 1-celled, rarely 2-celled. *Ovules* solitary, pendulous, or amphitropal, with the foramen uppermost. *Fruit* small nuts or utricle, 1-seeded, inclosed within the succulent receptacle, or collected in a fleshy head formed by the consolidated succulent calyx. *Seed* solitary, with a thin brittle testa; embryo lying in fleshy albumen, hooked, with the radicle long, superior, folded down towards the cotyledons.—*Trees* or *shrubs*, with a milky juice. *Leaves* furnished with stipules.

PROPERTIES.—Various. The milky juice of some species is bland and potable; of others acrid and poisonous. In India, *Ficus elastica* yields caoutchouc. *Maclura tinctoria* furnishes the dyewood called *Fustic*, whose colouring principle is termed *morine*.

¹ *Op. cit.* p. 13; see also *Annals of Medicine*, vol. ii. p. 403.

117. MORUS NIGRA, Linn.—THE COMMON MULBERRY.

Sex. Syst. Monœcia, Tetrandria.

(Fructus Succus, L.)

HISTORY.—The mulberry (*μωρέα*) is mentioned by Hippocrates¹—"Mora calefaciunt et humectant ac alvo secedunt," says the Father of Physic. Dioscorides² also speaks of the mulberry.

BOTANY.—**Gen. Char.**—Monœcious. *Catkins* unisexual. *Calyx* 4-lobed; the lobes concave. *Stamens* 4, alternate with the segments of the calyx. *Ovary* free. *Stigmas* 2. *Seeds* 1-2, covered by the pulpy calyx (*Bot. Gall.*).

Sp. Char.—*Leaves* cordate, ovate, lobed, or unequally dentate; rough and thickish. *Fruit* dark purple (*Bot. Gall.*).

Fig. 291.

*Morus Nigra.*

A small tree, with rugged bark. *Flowers* greenish. "*Fruit*, consisting of the female flowers, become fleshy and grown together, inclosing a dry membranous pericarp." (Lindley.)

Hab.—Native of Persia and China. Cultivated for its fruit. *Flowers* in May.

DESCRIPTION.—The fruit is usually called a *berry* (*bacca mori nigrae*), but is, in fact, that kind called by botanists a *sorosis*. Its odour is peculiar and agreeable; its taste is peculiar, pleasant, acidulous, and sweet. The juice is dark violet red.

COMPOSITION.—The fruit has not been analyzed. Its principal constituents are—*violet-red colouring matter, tartaric acid, sugar, and woody fibre*. The root has been analyzed by Wackenroder.³

PHYSIOLOGICAL EFFECTS.—Mulberries are alimentary in a slight degree; they allay thirst, diminish febrile heat, and, in large quantities, prove laxative.

USE.—They are employed as an agreeable aliment, and are well adapted to check preternatural heat and relieve thirst in fevers, but are objectionable when a tendency to diarrhœa exists. They owe their retention in the Pharmacopœia to their colour and flavour.

SYRUPUS MORI, L.; Syrup of Mulberry.—(Juice of Mulberries, strained, Oj; Sugar lbijss; Rectified Spirit fʒijss. Dissolve the sugar in the mulberry juice with a gentle heat, and set aside for twenty-four hours; then remove the scum, and pour off the clear liquor from the dregs if there are any. Lastly, add the spirit.)—Used as a colouring and flavouring substance. Its acidity prevents its being used with alkalies, earths, or their carbonates.

118. FICUS CARICA, Linn.—THE COMMON FIG.

Sex. Syst. Polygamia, Triœcia, Linn.—Polygamia, Diœcia, Willd.—Diœcia, Triandria, Pers.

(Fructus præparatus, L.—Fici: the dried fruit, E. D.)

HISTORY.—In the Old Testament we are informed that Hezekiah (who lived 600 years before Christ) used figs as a topical application to a boil.⁴ The fig-

¹ *De victus ratione*, lib. ii. p. 360, ed. Fœs.² *Gmelin's Handb. d. Chem.* ii. 1321.³ *Lib. i. cap. 160.*⁴ *Isaiah*, xxxviii. 21.

tree is the *σνξή* of Dioscorides,¹ the *Ficus* of Pliny.²

BOTANY. **Gen. Char.**—Monœcious. *Flowers* numerous, pedicellated, inclosed within a fleshy receptacle, which is umbilicated, and nearly closed at the apex, hollow within. *Calyx* 3—5-lobed : lobes acuminate. *Male-flowers* near the umbilicus. *Stamens* 3—5. *Ovary* free (Desf.) ; semi-adnate (Gaertn.). *Style* 1. *Stigmas* 2. *Drupe* or *utricle* 1-seeded, sunk into the pulpy receptacle. *Coat* of the nut fragile, crustaceous (*Bot. Gall.*).

Sp. Char.—*Leaves* cordate, palmate ; scabrous above, pubescent beneath (*Bot. Gall.*).—A small tree. *Flowers* in June. *Receptacle* green. At the base of each receptacle are two or three bracteal scales.

Hab.—Native of Asia and South of Europe.

DESCRIPTION.—Figs (*fici seu caricæ*) constitute that kind of collective fruit called, by Mirbel, a *syconus*. They consist of fleshy, hollow, pyriform receptacles, within which are numerous, small, seed-like bodies (*achenia*, Lindley ; *utricles*, Auctor). In the unripe state they contain an acrid and bitter juice, but which, when they are ripe, is replaced by sugar. Ripe figs are dried in the sun or in ovens, and are afterwards packed in drums and baskets, in which they are imported. As met with in the shops, they are more or less compressed, are covered with a whitish, saccharine efflorescence, have a brownish or yellowish colour, and are somewhat translucent. They have a peculiar and agreeable odour, and contain a sweet, viscid pulp, in which are the achenia. *Turkey* or *Smyrna figs* are the largest, most juicy, and sweetest ; hence they are sometimes termed *fat figs* (*caricæ pingues*) : they are distinguished into *pulled* and *flat*. Of 20,406 *cwt.* of figs, imported in 1830, no less than 18,801 came from Turkey (*Parliam. Return*).

COMPOSITION.—Bley³ analyzed Smyrna figs, and obtained the following results : *Sugar of figs* 62.5, *fatty matter* 0.9, *extractive with chloride of calcium* 0.4, *gum with phosphoric acid* 5.2, *woody fibre and seeds* [achenia] 15.0, and *water* 16.0=100.0.

PHYSIOLOGICAL EFFECTS.—Figs are nutritive, emollient, demulcent, and laxative. In the fresh state they are both agreeable and wholesome : when dried, as we receive them, they readily disorder the stomach and bowels, and occasion flatulence, griping, and mild diarrhœa.

USES.—In those countries where they are plentiful, figs are used as food. Here they are chiefly employed as a dessert. Internally they are given in the form of demulcent decoctions (as the *Decoctum Hordei compositum*, L. D.) in pulmonary and nephritic affections. As laxatives they are sometimes taken with the food to relieve habitual constipation, and enter into the composition of *Confectio Sennæ*, L. (*Electuarium Sennæ*, E.). Roasted or boiled, and split open, they are employed as suppurative cataplasms in gum-boil, &c.

Fig. 292.

*Ficus Carica.*

a. Section of Fruit. b. Stamens. c. Styles.

¹ Lib. i. cap. 183.² Pharm. Central-Blatt für 1831, S. 27.³ Hist. Nat. lib. xxiii. cap. 63.

119. DORSTENIA CONTRAJERVA, Linn.; and D. BRASILIENSIS, Lam.

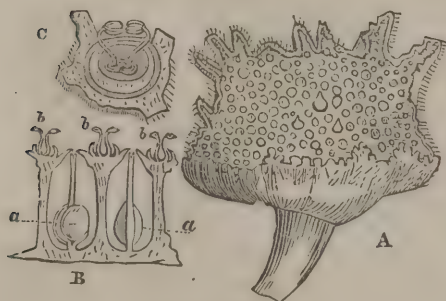
Sez. Syst. Tetrandria, Monogynia.

(Radix.)

HISTORY.—The earliest notice of this plant is that by Monardes,¹ who states that the word *contrajerva* is the Indo-Spanish term for alexipharmic or counter-poison. In 1581, Clusius² received from Sir Francis Drake a root, which he called, after the donor, *drakena radix*, and which has been supposed to be *contrajerva* root.

BOTANY. **Gen. Char.**—Monœcious. *Flowers* arranged upon a fleshy receptacle, usually flat and expanded, and extremely variable in form: *males* on the

Fig. 293.



Dorstenia Contrajerva.

A. Entire receptacle.
B. Section of ditto: a. Female flowers; b. Male ditto.
C. Male flower in its superficial hollow.

surface of the receptacle, 2-lobed, fleshy, diandrous; *females* immersed in the receptacle, also 2-lobed in most species. *Ovary* 1—2-celled, with a single suspended ovule in each cell. *Style* 1. *Stigma* 2-lobed. *Achenia* lenticular, imbedded in the fleshy receptacle, from which they are projected with elasticity when ripe.—Dwarf herbaceous plants with scaly rhizomata (Lindley).

Species.—1. *D. Contrajerva*, Linn.—Caulscent; stem covered with spreading green scaly stipules. *Leaves* palmate; the lobes lanceolate, acuminate, coarsely serrated and gashed, occasionally almost pinnatifid. *Receptacle* on a very long stalk, quadrangular, wavy, or plated

(Lindley). A native of New Spain, Mexico, Peru, Tobago, St. Vincent's (Willd.). The root of this is not met with in commerce.

2. *D. brasiliensis*, Lam.—A native of Jamaica, Brazil, and Trinidad. This yields the *contrajerva* root usually met with in the shops.

DESCRIPTION.—The *contrajerva* root (*radix contrajervæ*) usually found in the shops, is imported from the Brazils. It consists of an ovoid or oblong rootstock, terminating inferiorly in one or several long, tapering, more or less curved root-fibres. From the sides of the rootstock also arise numerous slender fibres. Externally the colour is yellowish-brown. The odour of the root is peculiar, but aromatic. The taste is warm, bitterish, slightly acid.

I have also found another kind of *contrajerva* root in the shops. The root-stalk is smaller, cylindrical, blackish-brown, with fewer fibres. The receptacle and leaves are attached; the latter are reniform. Is this the *drakena radix* of Clusius?

COMPOSITION.—The root has not been analyzed. It contains, according to Geiger,³ volatile oil, bitter extractive, and starch. To which may be added resin, free acid, and woody fibre.

PHYSIOLOGICAL EFFECTS.—Stimulant, tonic, and diaphoretic. Its operation is very analogous to that of serpentary root, between which and the rhizome of the sweet flag it deserves to be arranged. The root of the *Dorstenia brasiliensis* often proves emetic.⁴

¹ Clusius, *Exoticorum*, lib. x. p. 311.

² *Hand. d. Pharm.*

³ *Ibid.* p. 83.

⁴ De Candolle, *Essai sur les Propriétés Méd.*

USES.—Obsolete, or nearly so. It has been employed in fevers of a low type, and in other diseases requiring a mild, stimulant, and diaphoretic treatment.

ADMINISTRATION.—The dose of the root in powder is ʒj or ʒss. The infusion (prepared by digesting from ʒiv in fʒvj of boiling water) may be given in doses of fʒj or fʒij. The *pulvis contrajervæ compositus* (composed of powdered contrajerva root ʒv, and prepared shells lbjss) is no longer official.

ORDER XXXI. ARTOCARPACEÆ, Lindley.

ARTOCARPEÆ, R. Brown; Endl.

CHARACTERS.—Flowers unisexual, in dense heads. MALES:—Calyx 0, or consisting of 2—4 sepals. Stamens opposite the sepals. FEMALES:—Flowers arranged over a fleshy receptacle. Calyx tubular, with a 2—4-cleft or entire limb. Ovary free, 1-celled. Ovules suspended. Fruit surrounded by a dry or fleshy receptacle, or composed of consolidated fleshy calyxes, within which lies a multitude of nuts. Seeds erect, parietal or pendulous. Embryo more or less albuminous, straight, with the radicle directed towards the vertex of the ovary.—Trees or shrubs, with a milky juice. Leaves alternate. Stipules large, convolute.

PROPERTIES.—The milky juice is variable in quality: in some species being poisonous, in some edible, in others neither. It usually, if not invariably, contains caoutchouc.—The *Artocarpus incisa*, or Bread fruit tree, and the *A. integrifolia* or Jak fruit, deserve notice on account of their important alimentary uses. *Artocarpus incisa* is a native of the islands of the Pacific and of the Moluccas. Its fruit is to the inhabitants of Polynesia what corn is to the people of the other parts of the world. *Artocarpus integrifolia* is cultivated throughout southern India, and all the warmer parts of Asia. Its fruit forms a very considerable article of food in Ceylon.¹

120. *Antiaris toxicaria*, Leschinault.—Antsjar or Upas.

This is the celebrated *Antsjar* or *Upas* poison tree of Java, rendered notorious principally in consequence of certain gross falsehoods concerning it, about the year 1780, by a person of the name of Foersch, said to have been a surgeon in the service of the Dutch East India Company. Malefactors, says this person, when they receive sentence of death, are offered the chance of life, if they will go to the Upas-tree for a box of poison; and although every precaution is taken to avoid the injurious influence of the emanations of the tree, yet of 700 criminals who went to collect the poison, scarcely two out of twenty returned. Foersch further adds, that for fifteen or eighteen miles around this tree no living animal of any kind has ever been discovered.² Dr. Horsfield³ and M. Leschinault⁴ have shown that the above statements are for the most part fabulous. From their observations it appears that the true poison tree of Java is the *Antiaris toxicaria*⁵ (Fig. 295). It is one of the largest forest trees of Java, being from 60 to 100 feet high. The milky juice is collected by incision, and is then inspissated by boiling along with the juice of arum, galanga, onions, &c. The poison, when brought to this country, is found to be a thick fluid of a grayish-brown or fawn-colour, and an unpleasant odour. It consists, according to Pelletier and Caventon,⁶ of a peculiar elastic resin, slightly soluble gummy matter analogous to bassorin, and a bitter matter, soluble in water. This bitter matter is composed of a colouring matter absorbable by charcoal, an undetermined acid, and antiarin, the active principle of the plant, and which is precipitable by tincture of galls. More recently, Mulder⁷ has submitted this juice to analysis, and found it to consist of vegetable albumen 16.14, gum 12.34, antiar-resin 20.93, myricin 7.02, antiarin 3.56, sugar 6.31, and extractive 33.70. The antiar-resin was composed of C¹⁶H¹²O. Antiarin consisted of C¹⁴H¹⁰O⁵. Sir B. Brodie⁸ says, the poison renders the heart insensible to the stimulus of the blood. Magendie and Delile⁹ found that, besides acting on the brain and spinal marrow, it proved emetic. According to Audral, it causes convulsions, with alternations of relaxation.

¹ Hooker, *Bot. Mag.* vol. ii. N. S.

² See the translation of Foersch's paper, in Burnett's *Outlines of Botany*, 552; also, *Penny Magaz.* vol. ii. p. 321.

³ *Quarterly Journal*, vol. ii. p. 331.

⁴ *Ann. du Mus. d'Hist. Nat.* t. xvi. p. 176.

⁵ For a very elaborate account of this tree, by M. I. J. Bennett, see Dr. Horsfield's *Plantæ Javanicæ rarioræ*, p. 52.

⁶ *Ann. Chim. et Phys.* t. xxvi. p. 44.

⁷ *Pharmaceutisches Central-Blatt für 1839*, S. 511.

⁸ *Phil. Trans.* for 1811.

⁹ *Orfila, Toxicol. Gén.*

Fig. 294.



Arbor toxicaria. Ipo., Rumph.; Antiaris toxicaria, Leschinault.
(From Blume's *Rumphia*.)

ORDER XXXII. PIPERACEÆ, *Richard*.—PEPPERWORTS.

CHARACTERS.—*Flowers* naked, hermaphrodite, with a bract on the outside. *Stamens* 2 or more, arranged on one side, or all round the ovary; to which they adhere more or less; *anthers* 1—2-celled, with or without a fleshy connective; *pollen* roundish, smooth. *Ovary* superior, simple, 1-celled, containing a single erect, orthotropal *ovule*; *stigma* sessile, simple, rather oblique. *Fruit* superior, somewhat fleshy, indehiscent, 1-celled, 1-seeded. *Seed* erect, with the embryo lying in a fleshy sac, placed at the apex of the seed on the outside of the albumen.—*Shrubs* or *herbaceous plants*. *Stems* articulated. *Leaves* opposite, verticillate, or alternate, in consequence of the abortion of one of the pair of leaves. *Stipules* 0, or in pairs, or single and opposite the leaf. *Flowers* usually sessile, sometimes pedicellate, in spikes which are either terminal or axillary; or opposite the leaves (*Lindley*).

PROPERTIES.—Fruits remarkable for their hot taste, and acrid and stimulant properties. These qualities they owe to the presence of an acrid oil and resin.

121. PIPER NIGRUM, *Linn.*—THE BLACK PEPPER.

Sex. Syst. Diandria, Trigynia.

(*Fructus immaturus, L.*—Dried unripe berries, *E. D.*)

HISTORY.—The ancient Greeks were acquainted with pepper (πέπερι), their knowledge of which must have been derived, directly or indirectly, from the Hindoos. Hippocrates¹ employed it in several diseases. Pliny² notices its uses as a condiment,

¹ *De morb. mul. &c.*

² *Hist. Nat. lib. xii. cap. 14, ed. Valp.*

and expresses his astonishment that it should have come into general use, since it has neither flavour nor appearance to recommend it.

BOTANY. **Gen. Char.**—*Spadix* covered with flowers on all sides. *Flowers* hermaphrodite, rarely dioecious, each supported by a scale. *Stamina* 2 or more. *Orarium* with 1 solitary erect ovule. *Stigma* punctiform, obtuse, or split. *Berry* 1-seeded. *Embryo* dicotyledonous [monocotyledonous, *Blume*], inverted (*Blume*).¹

Sp. Char.—*Stem* shrubby, radicant, climbing, terete. *Leaves* ovate or elliptical, acuminate, occasionally somewhat oblique, subcordate, 5—7-nerved, coriaceous, smooth, recurved at the margin, glauco-greenish beneath. *Spadices* shortly pedunculated, pendulous. *Fruits* distinct (*Blume*).²

Stem 8—12 feet long, jointed, dichotomous. *Fruit* at first green, then red, afterwards black.

According to Dr. Roxburgh,³ *Piper trioicum* is cultivated, and yields excellent pepper.

Hab.—Cultivated in various parts of India and its islands (Roxburgh), also in the West Indies.

PREPARATION.—When any of the berries on a spadix change from green to red, the whole are considered fit for gathering; for, if they are allowed to become fully ripe, they are somewhat less acrid, and, moreover, easily drop off. When collected, they are spread out and dried in the sun, and the stalks separated by hand-rubbing. They are afterwards winnowed.⁴ The dried and shrivelled berries constitute *black pepper* (*piper nigrum*).

White pepper (*piper album*) is prepared from the best and soundest grains, taken at their most perfect stage of maturity. These being soaked in water, swell and burst their tegument, which is afterwards carefully separated by drying in the sun, hand-rubbing, and winnowing.⁵

COMMERCE.—The pepper countries extend from about the longitude of 90° to that of 115° E., beyond which no pepper is to be found; and they reach from 5° S. latitude to about 12° N., where it again ceases. The following estimate of the production of pepper is drawn up by Mr. Crawford.⁶

PRODUCTION OF PEPPER.	
Sumatra (west coast)	20,000,000 lbs.
Sumatra (east coast)	8,000,000
Islands in the Straits of Malacca	3,600,000
Malay peninsula	3,734,333
Borneo	2,666,667
Siam	8,000,000
Malabar	4,000,000
Total	50,000,000

DESCRIPTION.—*Black pepper* (*piper nigrum*) is round, covered externally with a brownish-black corrugated layer (the remains of the succulent portion of the berry), which may be readily removed by softening it in water. Internally we have a hard, whitish, spherical, smooth seed, which is horny externally, but farinaceous internally. The taste of both nucleus and covering is acrid and hot. Amongst wholesale dealers three sorts are distinguished:—

1. *Malabar pepper*.—This is the most valuable: it is *brownish-black*, free from stalks, and nearly free from dust.

2. *Penang pepper*.—This is *brownish-black*, larger, smoother, free from stalks, but very dusty. It is sometimes used in England to manufacture white pepper.

¹ *Enum. Plant. Java*, p. 61.

² *Fl. Indica*, vol. i. p. 153.

³ Marsden, *op. cit.*

⁴ *Op. cit.*

⁵ Marsden, *History of Sumatra*, 3d edit. p. 137.

⁶ McCulloch, *Dict. of Commerce*.

Fig. 295.



Piper nigrum.

3. *Sumatra pepper*.—This is the cheapest sort. It is *black*, mixed with stalks, and contains much dust. (Under the name of Sumatra pepper, some dealers include the Penang or brownish-black sort, and the black Sumatra sort.)

The heavier the pepper is, the more it is esteemed in the market. The heaviest of all, being hard and smooth, is called *shot pepper*, which is either Malabar or Sumatra sort; the Penang sort never yielding this kind of pepper.

Most dealers sift their black pepper before offering it for sale, and use the dust (called P. D.) for pickling or grinding.

Fulton's decorticated pepper is black pepper deprived of its husk by mechanical trituration.

Bleached pepper or *English bleached pepper* is Penang pepper bleached by chlorine. In this state it ought perhaps to be classed among the white peppers.

White pepper (*piper album*) is the fruit deprived of the external fleshy portion of the pericarp. The grains are larger than those of black pepper, spherical, whitish, and smooth, horny externally; internally they are farinaceous or hollow in the centre. They are less acrid and pungent than black pepper. In commerce three sorts are distinguished:—

1. *Tellicherry pepper*, which is of two kinds. *Large* or *fine Tellicherry pepper* is larger and whiter than any other description of white pepper, and fetches a higher price. *Small* or *coriander-like pepper* is shrivelled.

2. *Common white pepper* comes from Penang by Singapore. It is round and not shrivelled. Its value depends on its size and whiteness.

3. *English bleached white pepper*.—When the two preceding sorts are scarce, brown Penang pepper is bleached. The yellowest and largest grains are chosen for this purpose, for neither an expensive nor small sort would pay.

COMPOSITION.—In 1819, Oersted discovered *piperin* in pepper. In 1821, black pepper was analyzed by Pelletier.¹ In 1822, white pepper was analyzed by Lucä.²

BLACK PEPPER (*Pelletier*).

Acrid soft resin.
Volatile oil.
Piperin.
Extractive.
Gum.
Bassorin.
Starch.
Malic acid.
Tartaric acid.
Potash, calcareous and magnesian salts.
Woody fibre.

Black pepper.

WHITE PEPPER (*Luca*).

Acrid resin	10.00
Volatile oil	1.61
Extractive, gum, and salts	12.50
Starch	18.30
Albumen	2.50
Woody fibre	29.00
Water and loss	19.29

White pepper 100.00

Dr. Ure³ obtained from 100 parts of white peppercorns, a trace of volatile oil, $8\frac{1}{2}$ grains of a pungent resin containing a small fraction of piperin, about 60 grains of starch with a little gum, and nearly 30 grains of matter (lignin) insoluble in hot or cold water.

Lucä found no *piperin* in white pepper, but Poutet⁴ subsequently detected it. Probably, therefore, in Lucä's analysis the piperin was contained in the resin.

1. **RESIN OF PEPPER** (*resina piperis*).—This is a very acrid substance, soluble in alcohol and ether, but not so in volatile oils. It possesses in high perfection the acrid properties of pepper. Dissolved in ether, it was employed by Dr. Lucas in intermittents, and in two out of three cases with success.⁵ In the museum of the Pharmaceutical Society there are two kinds of pepper resin: one called the "green resin," the other the "red resin."

2. **VOLATILE OIL OF PEPPER** (*oleum piperis*).—When pure, this is colourless; it has the odour and taste of pepper. Its sp. gr. is 0.9932 (Lucä). Its composition is $C^{10}H^8$. It absorbs hydrochloric acid in large quantity, but does not form a crystalline compound with it. According to Meli,⁶ it possesses the same febrifuge properties as piperin, perhaps because it retains some of the latter principle. It has been used in some forms of dyspepsia depending on general debility.

¹ *Ann. de Chim. et de Phys.* xvi. 344.

² *Supplement to Ure's Dict. of Arts*, p. 200, 1844.

³ *Schwartz, Pharm. Tabellen.*

⁴ *Journ. de Pharm.* i. vii.

⁵ *Dierbach, Neuest. Entd. in d. Mat. Med.* Bd. i. S. 252, 1837.

⁶ *Dierbach, op. cit.*

3. PIPERIN.—This substance was discovered by Oersted in 1819, but was more accurately examined by Pelletier in 1821. It exists in black, white, and long pepper, and also in cubebs.

It is a crystalline substance, the crystals being rhombic prisms, with inclined bases. It fuses at 212°F ., is insoluble in cold water, and is only very slightly soluble in boiling water. Its best solvent is alcohol: the solution throws down piperin when water is added to it. Ether dissolves it, but not so readily as alcohol. Acetic acid likewise is a solvent for it.

Piperin, when pure, is white; but, as met with in commerce, it is usually straw-yellow. It is tasteless and inodorous. It was at first supposed to be an alkali; but Pelletier has shown that it possesses no analogy with vegetable alkalies, and that it is related to the resins. With strong sulphuric acid it forms a blood-red liquid. Nitric acid colours it first greenish-yellow, then orange, and afterwards red. The action of hydrochloric acid is similar.

Its formula, according to Regnault, is $\text{C}^8\text{H}^{10}\text{NO}^6$.

Piperin has been recommended and employed by Meli and several other physicians¹ as a febrifuge in intermittent fevers. It is said to be more certain and speedy, and also milder in its action, than the cinchona alkalies. Moreover, we are told that it might be procured at a cheaper rate than sulphate of quina. Its dose is about six or eight grains in powder or pills. Sixty grains have been taken in twenty-four hours, without causing any injurious effects. Meli considers two or three scruples sufficient to cure an intermittent. Magendie² proposes it in blennorrhagia, instead of cubebs.

4. STARCH.—Both black and white peppercorns contain abundance of very minute starch grains.

ADULTERATION.—Sago is said to have been used to adulterate ground white pepper. The microscope would readily detect the fraud; the starch grains of sago being very much larger than those of pepper, from which they also differ in shape. The following are the adulterations recently discovered³ in pepper by the microscope: wheat-flour, linseed meal, pea-flour, mustard-seed, and starch grains.

PHYSIOLOGICAL EFFECTS.—Pepper is one of the acrid species whose general effects have been already noticed (see vol. i. p. 252). Its great acidity is recognized when we apply it to the tongue. On the skin it acts as a rubefacient and vesicant.⁴ Swallowed, it stimulates the stomach, creates a sensation of warmth in this viscus, and, when used in small doses, assists the digestive functions, but if given in large quantities induces an inflammatory condition. Thirty white peppercorns, taken for a stomach complaint, induced violent burning pain, thirst, and accelerated pulse, which continued for three days, until the fruits were evacuated.⁵ Wendt, Lange, and Jager⁶ have also reported cases in which inflammatory symptoms supervened after the use of pepper. On the vascular and discerning systems pepper acts as a stimulant. It accelerates the frequency of the pulse, promotes diaphoresis, and acts as an excitant to the mucous surfaces. On one of my patients (a lady) the copious use of pepper induced burning heat of skin, and a few spots of *Urticaria evanida* usually on the face. "I have seen," says Van Swieten,⁷ "a most ardent and dangerous fever raised in a person who had swallowed a great quantity of beaten pepper." It has long been regarded as a stimulant for the urino-genital apparatus. The opinion is supported by the well-known influence of the peppers over certain morbid conditions of these organs. Moreover, the beneficial effect of pepper in some affections of the rectum leads us to suspect that this viscus is also influenced by these fruits.

USES.—It is employed as a condiment, partly for its flavour, partly for its stimulant influence over the stomach, by which it assists digestion. As a gastric stimulant it is a useful addition to difficultly-digestible foods, as fatty and mucilaginous matters, especially in persons subject to stomach complaints from a torpid or atonic condition of this viscus. Infused in ardent spirit it is a popular remedy for preventing the return of the paroxysms of intermittent fevers, given shortly before the expected attack. The practice is not recent, for Celsus⁸ advises warm water with pepper to relieve the cold fit. The febrifuge power of this spice has been fully proved, in numerous cases, by L. Frank,⁹ Meli,¹⁰ Riedmüller (Dierbach), and others;

¹ Dierbach, *Neurast. Entd. in d. Mat. Med.* Bd. i. S. 176, 1828.

² *Lancet*, Feb. 8, 1851.

³ Wibmer, *Arzneim. u. Gifte*, Bd. iv. S. 220.

⁴ *Commentaries*, English transl. vol. v. p. 57.

⁵ *Journ. Complém. du Dict. des Scienc. Méd.* t. viii. p. 371.

⁶ *Formulaire*.

⁷ Richard, *Dict. de Méd.* t. xvii. p. 307.

⁸ Quoted by Wibmer, *op. cit.* S. 119.

⁹ *Lib. iii. cap. 12.*

¹⁰ *Ibid.* t. xiii. p. 124.

though Schmitz¹ denies it. Barbier² says that, in some instances, where large doses were exhibited, death occurred in consequence of the aggravation of a pre-existent gastritis. It has been employed in gonorrhœa as a substitute for cubebæ. In relaxed uvula, paralysis of the tongue, and other affections of the mouth or throat requiring the use of a powerful acrid, pepper may be employed as a masticatory. In the form of ointment it is used as an application to tinea capitis. Mixed with mustard, it is employed to increase the acridity of sinapisms.

ADMINISTRATION.—The dose of black pepper (either of corns or powder) is from five to fifteen grains; the powder may be given in the form of pills.

1. CONFECTIO PIPERIS, L.; *Confectio Piperis Nigri*, D.; *Electuarium Piperis*, E.; *Confection of Black Pepper*.—(Black Pepper, Elecampane-root [Liquorice-root in powder, E.], of each ℥ij; Fennel ℥iij; Honey, White Sugar, of each ℥iij. Rub the dry ingredients together to a very fine powder, L. E.—Black Pepper in fine powder, Liquorice Root in powder, of each ℥ss; Refined Sugar ℥j; Oil of Fennel ℥ss; Clarified Honey, *by weight*, ℥ij, D. The London College keeps this in a covered vessel, and directs the Honey to be added when the Confection is to be used. But the Edinburgh and Dublin Colleges order the Honey to be added immediately after the ingredients have been mixed.)—This preparation is intended to be a substitute for a quack medicine, called “*Ward’s Paste*,” which has obtained some celebrity as a remedy for fistulæ, piles, and ulcers about the rectum. Its efficacy doubtless depends on the gentle stimulus it gives to the affected parts. Sir B. Brodie³ observes that severe cases of piles are sometimes cured by it; and he thinks that it acts on them topically, the greater part of the paste passing into the colon, becoming blended with the fæces, and in this way coming into contact with the piles, on which it operates as a local application, much as *vinum opii* acts on the vessels of the conjunctiva in chronic ophthalmia. In confirmation of this view, he mentions the case of a patient attended by Sir Everard Home, who was cured by the introduction of the paste into the rectum. Confection of black pepper is adapted for weak and leucophlegmatic habits, and is objectionable where much irritation or inflammation is present. The dose of it is from one to two or three drachms twice or thrice a day. “It is of no use,” says Sir B. Brodie, “to take this remedy for a week, a fortnight, or a month; it must be persevered in for two, three, or four months.” As it is apt to accumulate in and distend the colon, gentle aperients should be exhibited occasionally during the time the patient is taking the confection.

2. UNGUENTUM PIPERIS NIGRI; *Ointment of Black Pepper*.—(Prepared Hog’s Lard ℥ij; Black Pepper, reduced to powder, ℥iv. Make an ointment.)—Formerly in vogue for the cure of tinea capitis.

3. EXTRACTUM PIPERIS FLUIDUM, U. S.; *Fluid Extract of Black Pepper*.—Take of Black Pepper a pound; Ether a sufficient quantity. Put the powder into a percolator, and pour ether gradually upon it until two pints of filtered liquor are obtained. From this distil off, by means of a water-bath, at a gentle heat, a pint and a half of ether, and expose the residue, in a shallow vessel, until the whole of the ether has evaporated and the deposit of piperin and crystals has ceased. Lastly, separate the piperin by expression through a cloth and keep the liquid portion.

This preparation is of semifluid consistence, of a dark colour, and possessed strongly of the odour and taste of black pepper. It may be used where the article is usually employed. Dose, gtt. xx—f℥ss.]

¹ Rust’s Magaz. Bd. xvi.

² *Traité Élém. de Mat. Méd.* 2de édit. t. ii. p. 57.

³ *Lectures in Lond. Med. Gaz.* vol. xv. p. 716.

122. CHAVICA¹ ROXBURGHII, Miquel.²—COMMON LONG PEPPER.

Sex. Syst. Diandria, Trigynia.

(*Fructus immaturus*, L.—Dried Spikes, E.)

SYNONYMES.—*Piper longum*, Linn. in part; figure, in Nees' Plant. Medic. tab. 23.

HISTORY.—Long pepper (πέπερι μακρόν) is mentioned both by Dioscorides³ and Galen.⁴

BOTANY. **Gen. Char.**—Woody. *Spikes* solitary, opposite to the leaves. *Flowers* sessile, dioecious. *Bracts* with short stalks, nearly quadrangular, peltate. *Style* very short or 0. *Berries* sessile, united with the permanent bracts and the thickened rachis of the spike. *Seeds* oblong or almost lenticular, with a crustaceous finely scrobiculate testa and a mealy albumen.

Sp. Char—Rather hairy; lower leaves roundish ovate, 7-nerved; female spikes cylindrical, about as long as their stalk.

Hab.—India. Found wild among bushes on the banks of watercourses, up towards the Circar Mountains. It flowers and bears fruit during the wet and cold seasons (Roxburgh). It is cultivated in Bengal, and in the valleys amongst the Circar Mountains. The roots and thickest parts of the stems, when cut into small pieces and dried, form a considerable article of commerce all over India under the name of *Pippula moola*.

DESCRIPTION.—When fully grown, but yet unripe, the spadices are gathered and dried by exposure to the sun. They are then packed in bags for sale.

As met with in commerce, *long pepper* (*piper longum*) is grayish brown, cylindrical, an inch or more in length, having a mild aromatic odour but a violent pungent taste.

The long pepper imported from our possessions in India is the produce of *Chavica Roxburghii*, Mig. But that which is brought to Europe from the Dutch colonies is the produce of *Chavica officinarum*, Miq.

COMPOSITION.—This pepper was analyzed by Dulong in 1825.⁵ The following are the substances he obtained from it: *Acrid fatty matter* (resin?), *volatile oil*, *piperin*, *nitrogenous extractive*, *gum*, *bassorin*, *starch*, *malates* and *other salts*.

The VOLATILE OIL OF LONG PEPPER is colourless, and has a disagreeable odour and an acrid taste.

PHYSIOLOGICAL EFFECTS AND USES.—The effects of long pepper are analogous to those of black pepper. Cullen⁶ and Bergius⁷ consider it less powerful; but most other pharmacologists are agreed on its being more acrid. Medicinally it may be employed in similar cases. It is used principally for culinary purposes. It is a constituent of several pharmacopœial preparations.

123. Chavica Betle, Miquel.—Betle Pepper.

PIPER BETLE, Linnæus.—The leaf of this plant (as well as of *Chavica Siriboa*, Miq.) is extensively used by the Malays and other nations of the East, who consider it a necessary of life. The mode of taking it in Sumatra consists simply in spreading on the sirih (the leaf of the *Chavica Betle*) a small quantity of *chunan* (quick-lime prepared from calcined shells), and folding it up with a slice of *pinang* or Areca nut (see *ante*, p. 170). From the mastication there proceeds a juice which tinges the saliva of a bright red, and which the leaf and nut, without the lime, will not yield. This hue being communicated to the mouth and lips, is esteemed ornamental, and an agreeable flavour is imparted to the breath. The juice is usually, but not

¹ Chavica is the Sanscrit name for plants of this kind.

² *Systema Piperacearum*, Rotterdam, 1843. See also *Pharmaceutisches Central-Blatt für 1839*, pp. 415 and 431; and *für 1845*, p. 9;—and *Buchner's Repertorium*, Bd. xxxvi. S. 229, 1844; and Bd. xxxix. S. 14, 1845.

³ Lib. ii. cap. 189.

⁴ *Journ. de Pharm.* t. xi. p. 52.

⁵ *Mat. Med.* ed. 2da, t. i. p. 29.

⁶ *De Simpl. Med.* Facult. lib. viii. cap. xvi. 11.

⁷ *Mat. Med.* vol. ii. p. 209.

always, swallowed. To persons who are not habituated to this composition it causes giddiness, astringes and excoriates the mouth and fauces, and deadens for a time the faculty of taste. Individuals, when toothless, have the ingredients previously reduced to a paste, that they may dissolve without further effort.¹

124. CUBEBA OFFICINALIS, Miq.—THE CUBEBA PEPPER.

Sex. Syst. Diandria, Trigynia.

(Fructus immaturus, *L.*—Fruit, *E.*—The berries, *D.*)
[Cubeba; Cubebs, *U. S.*]

SYNONYME.—*Piper Cubeba*, Linn. fil. Blume. *Ph. L.*

HISTORY.—It is somewhat doubtful when cubebs were first employed in medicine, and by whom they were first noticed. I am inclined to believe, however, that they are mentioned in the Hippocratic writings² under the name of *μυρτίδαρον*; for 1stly, the remedy termed *μυρτίδαρον* is distinguished from pepper (*πέπερι*), and is said to be a round Indian fruit which the Persians call pepper. 2dly, the modern Greek name for cubebs is *μυρτίδαρον*.³

The word cubebs is derived from the Arabic name for these fruits, which first occurs in the writings of Serapion,⁴ Rhazes, and Avicenna. From the same source Actuarius⁵ derived the name *κομβέδας*, by which he has designated cubebs.

Cubebs were in use in England more than 500 years ago, for in 1305 Edward I. granted to the corporation of London the power of levying a toll of one farthing a pound on this article in its passage over London Bridge.⁶

BOTANY. Gen. Char.—Woody. *Spikes* solitary, opposite the leaves. *Flowers* dioecious. *Ovary* sessile. *Stigmas* 3—5, sessile. *Berries*, by the contracted basis, apparently stalked (pseudo-pedicillate). *Seed* roundish, with leathery or horny testa and mealy albumen. (Condensed from Miquel).

Sp. Char.—*Leaves* smooth; the lower ones unequal, somewhat cordate at the base, ovate, acute; the upper ones more oblong-ovate, with rounded base and smaller; those of the male plant 5-nerved, of the female plant 5—9-nerved. *Fruit* globose, shorter than their stalks.—A climbing shrub.

Hab.—Grows wild in Bantam, the western part of Java; also on some of the neighbouring islands.—Cultivated in the lower parts of Java.

The above is, according to Miquel, the mother-plant of the genuine cubebs. But a neighbouring species—*Cubeba canina*, Miquel—yields a fruit which, according to Blume, also forms part of the cubebs of commerce. This plant grows on the Sunda and Molucca islands. The fruits and seeds of the two species are thus distinguished.

C. OFFICINALIS, Miq.

Berries far more numerous, crowded, almost globose, scarcely acuminate; when dry, rugous, blackish brown, having a very acrid, aromatic, almost bitter taste.

Seed-coat (spermoderm), grayish brown, traversed by about eight longitudinal nerves, oblong-globular.

Fruit-Stalks (formed of the thin lower portion of the berry) longer than the berries.

C. CANINA, Miq.

Fewer, more remote, ovate; when dry, remarkably beaked (rostrate), black, smaller, scarcely rugous, having a weaker, almost anise-like taste.

Reddish, almost shining, lined (*striolata*) longitudinally, spherical.

Nearly of the same length as the berries.

DESCRIPTION.—The dried unripe fruit of this plant constitutes the *cubebs* (*cubebe* vel *piper caudatum*) of the shops.

In appearance, cubebs resemble black pepper, except that they are lighter coloured,

¹ Marsden, *Hist. of Sumatra*, 3d edit. p. 281.

² *De Morbis Mulierum*, lib. ii. p. 672, ed. Fæsius.—The term *μυρτίδαρον* was also used to signify a myrtle-like plant, and likewise a rough excrescence growing on the *μυρτίνη* (*Ruscus aculeatus*). See Dioscorides, lib. i. cap. 156.

³ *Pharmacopœia Græca*. Athenis, 1837.

⁴ In his account of cubebs, Serapion has translated what Dioscorides has said of *μυρτίνη* (*Ruscus aculeatus*) and added everything which Galen has stated respecting *καρπύσιον*. But Galen expressly states that *καρπύσιον* resembles *ζω* (the root of *Valeriana* Dioscorides); and it is improbable, therefore, that cubebs and carpesium should be identical.

⁵ C. Bauhini *Pinax*.—No Greek edition of Actuarius has been published, and I am, therefore, obliged to quote his writings at second-hand. In my copy of the Latin translation (*De Medicamentorum compositione*, J. Ruellio interprete, p. 69 b, 1516), the phrase runs thus—“carpesi (cubebe barbari vocant).”

⁶ *Liber Niger Scaccarii*, vol. i. p. *478; also *The Chronicles of London Bridge*, p. 155.

and are each furnished with a stalk two or three inches long, and from which circumstance they have received their name *caudatum* ("fructus pedicellatus," Ph. Lond.). The cortical portion of cubebs (that which constituted the fleshy portion of the fruit) appears to have been thinner and less succulent than in black pepper. Within it is a hard spherical seed, which is whitish and oily. The taste of cubebs is acrid, peppery, and camphoraceous; the odour is peculiar and aromatic.

COMPOSITION.—Three analyses of cubebs have been made: one by Trommsdorff, in 1811;¹ a second by Vauquelin, in 1820;² and a third by Monheim, in 1835.³

Vauquelin.	Monheim.
1. Volatile oil, nearly solid.	1. Green volatile oil 2.5
2. Resin, like that of copaiva.	2. Yellow volatile oil 1.0
3. Another coloured resin.	3. Cubebin 4.5
4. A coloured gummy matter.	4. Balsamic resin 1.5
5. Extractive.	5. Wax 3.0
6. Saline matter.	6. Chloride of sodium 1.0
	7. Extractive 6.0
	8. Lignin 65.0
	Loss 15.5
Cubebs.	Cubebs 100.0

1. ESSENTIAL OIL OF CUBEBS.—(See p. 356.)

2. RESIN OF CUBEBS.—Vauquelin has described two resins of cubebs: one is green, liquid, acrid, and analogous, both in odour and taste, to balsam of copaiva; the other is brown, solid, acrid, and insoluble in ether.

3. CUBEBIN (*Piperin*).—From cubebs is obtained a principle to which the term *cubebin* has been applied. It is very analogous to, if not identical with piperin. Cassola, a Neapolitan chemist,⁴ says, it is distinguished from the latter principle by the fine crimson colour which it produces with sulphuric acid, and which remains unaltered for twenty or twenty-four hours; moreover, cubebin is not crystallizable.

Monheim,⁵ however, declares cubebin to be identical with piperin, and that it is combined with a soft acrid resin. In this state it is soluble in ether, alcohol, the fixed oils, and acetic acid; but it is insoluble in oil of turpentine and dilute sulphuric acid. It fuses at 68° F.

Dr. Görres⁶ gave cubebin, in both acute and chronic gonorrhœa, to the extent of one drachm, four times daily. But he premised the use of phosphoric acid.

4. EXTRACTIVE MATTER OF CUBEBS.—Vauquelin says, the extractive matter of cubebs is analogous to that found in leguminous plants. It is precipitable by galls, but not by acetate of lead.

PHYSIOLOGICAL EFFECTS.—Cubebs belong to the acrid species already (see *ante*, p. 221) noticed. Their sensible operation is very analogous to that of black pepper. Taken in moderate doses, they stimulate the stomach, augment the appetite, and promote the digestive process. In larger quantities, or taken when the stomach is in an irritated or inflammatory condition, they cause nausea, vomiting, burning pain, griping, and even purging. These are their local effects. The constitutional ones are those resulting from the operation of an excitant—namely, increased frequency and fulness of pulse, thirst, and augmented heat. It probably stimulates all the mucous surfaces, but unequally so. In some instances cubebs give rise to an eruption on the skin like urticaria. Not unfrequently they cause headache; and occasionally disorder of the cerebro-spinal functions, manifested by convulsive movements or partial paralysis, as in a case related by Mr. Broughton.⁷

Cubebs appear to exercise a specific influence over the urinogenital apparatus. Thus they frequently act as diuretics, and at the same time deepen the colour of, and communicate a peculiar aromatic odour to the urine. Their stimulant operation on the bladder is well illustrated by a case related by Sir Benjamin Brodie.⁸ A gentleman, labouring under chronic inflammation of the bladder, took fifteen grains of cubebs, every eight hours, with much relief. Being anxious to expedite his cure, he, of his own accord, increased the dose to a drachm. This was followed by an aggravation of the symptoms: the irritation of the bladder was much in-

¹ Schwartz. *Pharm. Tabell.*

² *Journ. de Pharm.* xx. 403.

³ *Op. cit.*

⁴ *Lond. Med. Gaz.* vol. i. p. 405.

⁵ *Ann. Phil.* 2d series, vol. iii. p. 202.

⁶ *Journ. de Chim. Méd.* t. x. p. 685.

⁷ Dierbach, *Neuesten Entd. in d. Mat. Med.* S. 253, 1837.

⁸ *Ibid.* vol. i. p. 300.

creased, the mucus was secreted in much larger quantity than before, and ultimately the patient died—"his death being, I will not say occasioned," adds Sir Benjamin, "but certainly very much hastened, by his imprudence in overdosing himself with cubebs."

Three drachms of cubebs caused in Pül¹ nausea, acid eructations, heat at the pit of the stomach, headache, uneasiness, and fever.

USES.—The principal use of cubebs is in the treatment of *gonorrhœa*. They should be given in as large a dose as the stomach can bear, in the early part of the disease; for experience has fully proved that, in proportion to the length of time gonorrhœa has existed, the less amenable is it to the influence of cubebs. In some instances an immediate stop is put to the progress of the malady. In others the violent symptoms only are palliated; while in many (according to my experience in most) cases no obvious influence over the disease is manifested. The presence of active inflammation of the urethra does not positively preclude the use of cubebs, though I have more than once seen them aggravate the symptoms. Mr. Jeffreys² thinks the greatest success is met with in the more inflammatory forms of the disease. Cubebs have been charged with inducing swelled testicle; but I have not observed this affection to be more frequent after the use of cubebs than when they were not employed. Mr. Broughton³ gave them to fifty patients, and in forty-five they proved successful. Of these only two had swelled testicle. The explanation of the *methodus medendi* is unsatisfactory. Sir A. Cooper⁴ thinks that cubebs produce a specific inflammation of their own on the urethra, which has the effect of superseding the gonorrhœal inflammation. The occasional occurrence of a cutaneous eruption from the use of cubebs deserves especial attention, as I have known it create a suspicion of secondary symptoms.

Cubebs have been recommended in gleet and leucorrhœa.⁵ In abscess of the prostate gland, twenty or thirty grains of cubebs, taken three times a day, have in many cases appeared to do good.⁶ They seemed to give a gentle stimulus to the parts, and to influence the disease much in the same way that Ward's Paste operates on abscesses and fistulæ, and ulcers of the rectum. In cystirrœa also they have occasionally proved serviceable in small doses.⁷ In piles, likewise, they are given with advantage.⁸

The efficacy of cubebs in mucous discharges is not confined to the urinogenital mucous membrane. In catarrhal affections of the membrane lining the aerian passages, it proves exceedingly useful, especially when the secretion is copious and the system relaxed.

Formerly cubebs were employed as gastric stimulants and carminatives in dyspepsia, arising from an atonic condition of the stomach. They have also been used in rheumatism. The Indians macerate them in wine, and take them to excite the sexual feelings.

ADMINISTRATION.—Cubebs, in the form of *powder*, are given in doses varying from ten grains to three drachms. In affections of the bladder and prostate gland the dose is from ten grains to thirty grains. In gonorrhœa, on the other hand, they should be administered in large doses. Mr. Crawford⁹ says, that in Malay countries they are given in doses of three drachms, six or eight times during the day.

1. *OLEUM CUBEBÆ*, E.; *Volatile Oil of Cubebs*. (Prepared by grinding the fruit, and distilling with water.)—By distillation, cubebs yield about 10.5 per cent. of a transparent, slightly-coloured (when pure, colourless) volatile oil, which is lighter than water (sp. gr. 0.929), and has the cubeb odour, and a hot, aromatic, bitter taste. Its formula is $C^{10}H^8$.

¹ *Arzneim. u. Giften*, Bd. iv. S. 217.

² *Observations on the Use of Cubebs, or Java Pepper, in the Cure of Gonorrhœa*. 1821.

³ *Med.-Chir. Trans.* vol. xii. p. 99.

⁴ *Lancet*, vol. iii. p. 201, 1824.

⁵ Dr. Orr, *Ed. Med. Journ.* vol. xviii. p. 318.

⁶ Sir B. Brodie, *Lond. Med. Gaz.* vol. i. p. 396.

⁷ *Ibid.* p. 360.

⁸ *Ibid.* xv. 747.

⁹ *History of the Indian Archipelago*, vol. i. p. 465.

By keeping, it sometimes deposits crystals (*cubeb stearoptene* or *cubeb camphor*), the primary form of which is the rhombic octohedron.¹ They form a hydrate whose composition is $C^{10}H^{18},HO$. Their odour is that of cubebs; their taste, at first, that of cubebs and camphor, afterwards cooling. They are fusible at $133^{\circ} F.$, soluble in alcohol, ether, and oils, but are insoluble in water. Oil of cubebs is an excellent and a most convenient substitute for the powder. The dose of it, at the commencement of its use, is ten or twelve drops. This quantity is to be gradually increased as long as the stomach will bear it. In some instances, I have given it to the extent of a fluidrachm for a dose. It may be taken suspended in water by means of mucilage, or dropped on sugar; or in the form of *gelatinous capsules of cubebs*, a combination of oil of cubebs and oil of copaiva forms a very useful medicine in some cases of gonorrhœa.

2. **EXTRACTUM OLEO-RESINOSUM CUBEBE;** *Oleo-resinous Extract of Cubebs.*—Dublane directs this to be prepared by adding the oil to the resinous extract of cubebs, which is prepared by digesting the cake, left after the distillation of the oil, in alcohol, and distilling off the spirit.² The process of Mr. Procter, Jun.,³ appears to be a better one. It consists in exhausting cubebs by ether in the displacement apparatus, and submitting the ethereal tincture to distillation in a water bath. The residual *etheral extract of cubebs* has a dark olive brown colour, and contains all the volatile oil, cubebin, and resin (the active principles of the fruit) as well as most of the waxy matter, but none of the extractive. 1 lb. avoirdupois of cubebs yields 2 oz. of ethereal extract. One drachm of it, therefore, is equal to one ounce of cubebs. It may be administered in the form of emulsion, pills, or capsules. Dose from grs. v to 3ss.

3. **EXTRACTUM CUBEBE FLUIDUM, U. S.;** *Fluid Extract of Cubebs.*—Take of Cubebs a pound; Ether a sufficient quantity. Put the cubebs into a percolator, and having packed it carefully, pour ether gradually upon it until two pints of filtered liquor are obtained, then distil off, by means of a water-bath at a gentle heat, a pint and a half of the ether, and expose the residue, in a shallow vessel, until the whole of the ether has evaporated. The above are the directions in full adopted by the *U. S. Pharm.* from Mr. Procter. The dose is as above stated.]

4. **TINCTURA CUBEBE, L. [U. S.];** *Tinctura Piperis Cubebæ, D.;* *Tincture of Cubebs.*—(Cubebs, powdered, 1lbj [5v, D. (3iv, U. S.)]; Proof [Rectified, D.] Spirit Oij [Diluted Alcohol Oij, U. S.]. Macerate for seven [fourteen, D. (U. S.)] days, then express and strain.—Dr. Montgomery⁴ says, "I have found this tincture cure gonorrhœa, both speedily and satisfactorily." The dose of it is one or two drachms three times a day.

Some druggists keep a more concentrated tincture.

125. *Artanthe elongata*, Miquel.—MatICO-plant.

Sex. Syst. Diandria, Monogynia.

(Herba; folia.—The Leaves, D.)

Piper angustifolium, Ruiz and Pavon, Fl. Peruv.; *Piper elongatum*, Vahl.; *Stephensia elongata*, Kunth; *Moho Moho* id est *Nodus Nodus*, vernacul. name.—This plant has long been in use among the natives of Peru in venereal diseases; and having been employed on some occasion by a soldier as a mechanical agent to staunch blood, it got the name of the *Soldier's herb*, and, in 1839, was introduced into this country as an internal or chemical styptic. The term *matico* (*materó* or *matica*) is not exclusively applied to the leaves of this plant; but to those of others also. Dr. Lindley has given to the Museum of the Pharmaceutical Society some leaves of the *Eupatorium glutinosum*, Kunth. They are marked *Matico*, and are said to be excellent in powder for staunching blood and healing wounds. In appearance and texture they closely resemble the leaves of *Artanthe elongata*; and would, I doubt not, be equally valuable as mechanical styptics.

Artanthe elongata is a shrub of about 12 feet high, with jointed stem and branches. Its leaves are harsh, short-stalked, oblong lanceolate, acuminate: pubescent beneath, tessellated or rough on the upper side on account of the sunken veins. The spikes are solitary, cylindrical,

¹ Brooke, *Ann. Phil. N.S.* vol. v. p. 450.

² *Pharmaceutical Journal*, vol. vi. p. 319, 1846.

³ *Journ. de Pharm.* t. xiv. p. 40.

⁴ *Observations on the Dubl. Pharm.* p. 439, Lond.

and opposite the leaves; the bracts lanceolate; and the flowers hermaphrodite.—It grows at Huanuco, Cuchero, Pano, Chaclea and Muna in Peru; and flowers from July to September.

Matico (*herba matico* vel *matica*) is imported in serons, and consists of the dried leaves, stalks, and spikes (some unripe, others ripe), and more or less compressed into a lump. The colour of the dried plant is greenish; and the leaves, which are from 2 to 8 inches long, in structure somewhat resemble those of sage, and are easily reducible to powder. The plant has an aromatic odour somewhat similar to that of cubebs.

Matico has been analyzed by Dr. J. F. Hodges,¹ who found the following substances in it:—an aromatic volatile oil, a bitter principle (maticine), a soft dark green resin, a brown colouring matter, a yellow colouring matter, chlorophylle, gum and nitrate of potash, salts, and lignin.—The oil of matico has a light green colour, and when recent, the consistence of good castor oil, but becomes thick and crystalline on keeping. The bitter principle called maticine, is soluble in alcohol and water, but not in ether.

Infusion of matico yields a dark greenish colouring and precipitate with the sesquichloride of iron;² but undergoes no change on the addition of gelatin, emetic tartar, or perchloride of mercury. It, therefore, contains little or no tannin. Acetate of lead and infusion of nutgalls each occasion copious coloured precipitates.

Matico is an aromatic bitter stimulant, which agrees with cubebs and the pepper in the character of its effects. Its active principles are volatile oil, resin, and the bitter principle.

Matico may be used (like lint, felt, cobweb, &c.) as a topical application for staunching blood, or from slight cuts and other wounds, leech-bites, the nose, gums, &c. It acts mechanically as a styptic by the structure of its leaf, which divides the blood and promotes its coagulation.

As an internal remedy it is applicable as a substitute for cubebs, in discharges from the mucous surfaces, as leucorrhœa, gonorrhœa, &c. It might, perhaps, be useful in affections of the rectum, in similar cases to those in which the confection of pepper has been serviceable. The Indians use the infusion as an aphrodisiac.³

Matico has been greatly lauded⁴ as an internal styptic or astringent in internal hemorrhages (from the lungs, stomach, bowels, and uterus). But the botanical, chemical, and sensible qualities of matico are opposed to the idea of its astringent properties; and with regard to the supposed therapeutic evidence, it may be observed that from the often temporary character and uncertain duration of internal hemorrhages generally, it is very difficult to determine the therapeutical influence of the agents called astringents, and to distinguish *post hoc* from *propter hoc* phenomena. If matico have any styptic power, it is derived not from tannic or gallic acids, but from the volatile oil which the plant contains; and in that case the oils of pepper, cubebs, or turpentine, would be much more energetic and preferable.

[Dr. Ruschenberger, who became acquainted with it during a visit to Peru in 1834, and introduced it into the United States, has used it locally in chronic ophthalmia with advantage. With regard to its anti-hemorrhagic power, the latter gentleman informs me that he applied it to arrest hemorrhage after an operation on the side of the neck below the angle of the jaw, in which there was considerable bleeding and difficulty in taking up the divided vessels, owing to induration of the part from chronic inflammation; and the application was successful. The same arrest of the discharge of blood followed its use in hæmatemesis.]

Matico is administered in the form of powder, infusion, and tincture. The dose of the powder is from ℥ss to ℥ij.

1. **Infusum Matico**, D.; *Infusion of Matico*.—(Matico Leaves, cut small, ℥ss; Boiling Water Oss. Infuse for one hour, in a covered vessel, and strain. The product should measure about eight ounces. D.)—Dose from ℥j to ℥ij.

2. **Tinctura Matico**, D.; *Tincture of Matico*.—(Matico Leaves, in coarse powder, ℥viij; Proof Spirit Oij. Macerate for fourteen days, strain, express, and filter, D.)—Dose from ℥j to ℥ij.

ORDER XXXIII. EUPHORBIACEÆ, Juss.—SPURGEWORTS.

EUPHORBIÆ, Juss.

CHARACTERS.—Flowers unisexual. *Calyx* free (inferior), with various glandular or sealy internal appendages; sometimes wanting. *Corolla* usually absent, sometimes polypetalous or monopetalous. *Stamens* definite or indefinite, distinct or monadelphous; *anthers* 2-celled. *Ovary* free (superior). *Ovules* solitary or twin, suspended from the inner angle of the cell. *Fruit* generally tricocous, consisting of 3 carpels splitting and separating with elasticity from their common axis, occasionally fleshy and indehiscent. *Seeds* solitary or twin, suspended often with an aril; embryo enclosed in fleshy albumen; cotyledons flat; radicle superior.—*Trees, shrubs, or herbs*, often abounding in a milky juice. *Leaves* opposite or alternate, simple, rarely compound, often with stipules. *Flowers* axillary or terminal, sometimes inclosed within an involucre re-

¹ *Memoirs and Proceedings of the Chemical Society*, vol. ii. p. 123, 1841.

² Peppermint and other labiate plants yield infusions which produce a dark green colour with the sesquichloride of iron.

³ Martius, *Pharmaceutical Journal*, vol. ii. p. 660, 1843.

⁴ See Jeffrey's *Remarks on Matico*, 1813.

sembling a calyx. Some of the Euphorbiaceæ are succulent or fleshy, and have a considerable resemblance to Cactaceæ; from which they may in general be distinguished by the presence of an acrid milky juice.

PROPERTIES.—Mostly acrids; operating, toxicologically, as acrid, narcotic-acrid, or acro-narcotic poisons; and medicinally, as rubefacients, suppurants, emetics, diuretics, and cathartics. The acrid or poisonous principle or principles reside in the roots, stems, leaves and seeds. It is a constituent of the acrid milky juice found in many of the species. "M. Berthollet has recorded a remarkable instance of the harmless quality of the sap in the interior of a plant, whose bark is filled with a milky proper juice of a poisonous nature. He described the natives of Tene-riffe as being in the habit of removing the bark from the *Euphorbia canariensis*, and then sucking the inner portion of the stem in order to quench their thirst, this part containing a considerable quantity of limpid and non-elaborated sap."¹ In some cases an acrid principle (see vol. i. p. 206) is found in the embryo, but not in the albumen of the seed. Thus Aublet² states that the kernels of *Omphalea diandra* are edible if the embryo be extracted; but if this be left in, they prove cathartic. In some cases, however, as those of *Croton* and *Ricinus*, the albumen also possesses acrid and poisonous properties. The chemical nature of the acrid principle or principles has not been determined. In some cases it appears to be volatile, in others fixed. If it be true that persons have been poisoned by sleeping under the Manchinee tree (*Hippomane Mancinella*), this species must give out a poisonous vapour. In some cases, however, resin appears to be the active principle; as in the officinal substance called gum euphorbium.

The expressed oils of the seeds of several of the Euphorbiaceæ (as *Croton*, *Ricinus*, *Jatropha*, *Euphorbia*, and *Anda*) are purgative; in some cases violently so. They probably owe this to some active principle dissolved in the fixed oil; for the residual oil cake acts as a drastic purgative, in some cases more so than the expressed oil. Soubeiran³ thinks that some of the euphorbiaceous seeds owe their purgative qualities to resin. The fixed oil of some of the seeds is remarkable for its more ready miscibility with, or solubility in, alcohol, than most other fixed oils.

Some euphorbiaceous plants are devoid of acridity, or possess it in a very slight degree only. Some of these are aromatic, resiniferous, and tonic. Von Buch⁴ says, the branches of *Euphorbia balsamifera* contain a mild sweet juice, which is eaten by the inhabitants of the Canary Isles. The aromatic tonic bark of the *Croton Eleutheria* is another exception to the very general acridity of these plants.

Some of the roots are harmless and nutritious. Others of neighbouring species abound in nutritive starch (e. g., *tapioca-starch*), which resides in a poisonous juice.

TRIBE. EUPHORBIEÆ, Bartling.

Ovules solitary. *Seeds* albuminous. *Flowers* monœcious, apetalous; male and females mixed in a cup-shaped involucre.

126. EUPHORBIA CANARIENSIS, Linn.—THE CANARY EUPHORBIA.

Sex. Syst. Dodecandria, Trigynia, Linn.—Monœcia, Monandria, Smith.

(*Euphorbium*; *gummi-resina*, L. D.—Concrete resinous juice, E.)

HISTORY.—The plant which yields the saline waxy-resin called in the shops *gum euphorbium*, is said both by Dioscorides⁵ (who calls it *εὐφώβιον*) and Pliny⁶ to have been first discovered in the time of Juba, king of Mauritania; that is, about, or a few years before, the commencement of the Christian era. Pliny says that Juba called it after his physician, Euphorbus; and that he wrote a volume concerning it, which was extant in Pliny's time. Salmasius, however, states that this word occurs in the writings of Meleager the poet, who lived some time before Juba. But in the passage in question the commonly received reading in the present day is not *εὐφώβιος*, but *ἐκ φωβῆς*.⁷

BOTANY. Gen. Char—*Flowers* collected in monœcious heads, surrounded by an involucre consisting of 1 leaf with 5 divisions, which have externally 5 glands alternating with them. *Males* naked, monandrous, articulated with their pedicel, surrounding the female, which is in the centre. *Females* naked, solitary. *Ovarium* stalked. *Stigma*s 3, forked. *Fruit* hanging out of the involucre, consisting of

¹ Henstow, *Botany*, in Lardner's *Cyclop.* p. 217.

² *Journ. de Pharm.* t. xv. p. 501, 1829.

³ Nees and Ebermaier, *Med. Pharm. Bot.* Bd. i. S. 335

⁵ Lib. iii. cap. 96.

⁶ *Hist. Nat.* lib. xxv. cap. 38, ed. Vaip. Pliny calls the plant *euphorbia*, and the resin *euphorbium* (lib. xxvi. cap. 31).

⁷ Dr. Greenhalgh, *Dict. of Greek and Roman Biography*, art. *Euphorbus*, vol. ii. p. 97.

3 cells, bursting at the back with elasticity, and each containing 1 suspended seed (Lindley).

Sp. Char.—Branches channelled, with 4, rarely 5, angles, armed with double, straight, spreading, dark, shining spines.

These specific characters apply to the branches found mixed with the euphorbium of commerce. They agree with the description and figure of *Tithymalus aizoides lactifluus* seu *Euphorbia canariensis* of Plukenet.¹ This agrees with the statement of Miller,² who states that by looking over some euphorbium in a shop, he “found several spines amongst it, which exactly agreed with those of that plant.” I feel very little hesitation, therefore, in referring the euphorbium of English commerce to *E. canariensis*; the species still retained by the Dublin College.

From the *E. canariensis* of Willdenow and of some other botanists, this plant is distinguished by its straight spines; but on examining the *E. canariensis* at the Kew Garden, I find as many of the spines straight as uncinatæ. The diameter of the stems, however, and even of the young shoots, is greater than that of stems found in the euphorbium of commerce. The species which most closely agrees with the latter in the sizes of the stems, the number of angles, and the number and directions of the spines, is *Euphorbia tetragona*. This species has mostly square stems; though some of the larger stems are somewhat channelled. The dried stems found in the euphorbium of commerce, however, appear to be uniformly channelled. The *E. officinarum* (adopted by the London College) has many angles: the *Dergmuse* of Jackson³ has many scalloped angles. *Euphorbia antiquorum* has been said to yield euphorbium, but the statement is denied by both Hamilton⁴ and Royle.⁵

Hab.—The Canary Islands; Africa, in the neighbourhood of Mogadore?

EXTRACTION.—Euphorbium is thus procured: The inhabitants of the lower regions of the Atlas range make incisions in the branches of the plant, and from these a milky juice exudes, which is so acrid that it excoriates the fingers when applied to them. This exuded juice hardens by the heat of the sun, and forms a whitish-yellow solid, which drops off in the month of September, and forms the euphorbium of commerce. “The plants,” says Mr. Jackson,⁶ “produce abundantly once only in four years; but this fourth year’s produce is more than all Europe can consume.” The people who collect it, he adds, are obliged “to tie a cloth over their mouth and nostrils to prevent the small dusty particles from annoying them, as they produce incessant sneezing.” The acrid resinous juice resides in the outer or cortical portion of the stem (see *ante*, p. 359).

PROPERTIES.—Euphorbium consists of irregular yellowish, slightly friable tears, usually pierced with one or two holes, united at the base, and in which we find the remains of a double aculeus. These tears are almost odourless; but their dust, applied to the olfactory membrane, acts as a powerful sternutatory. Their taste is at first slight, afterwards acrid and burning.

When heated, euphorbium melts, swells up imperfectly, evolves an odour somewhat like that of benzoic acid vapour, takes fire, and burns with a pale flame. Alcohol, ether, and oil of turpentine are its best solvents; water dissolves only a small portion of it.

COMPOSITION.—Euphorbium has been the subject of several analyses—namely, in 1800, by Laudet;⁷ in 1809, by Braconnot;⁸ in 1818, by Pelletier⁹ and by Mühlmann;¹⁰ in 1819, by Brandes;¹¹ and more recently by Drs. Buchner and Herberger.¹²

Pelletier's Analysis.		Brandes's Analysis.	
Resin	60.8	Resin	43.77
Wax	14.4	Wax	11.93
Bassorin	2.0	Caoutchouc	4.84
Malate of lime	12.2	Malate of lime	1.82
Malate of potash	1.8	Malate of potash	4.90
Water and loss	8.8	Sulphates of potash and lime, and phosphate of lime	0.79
		Water and loss	6.44
		Woody fibre	5.60
Euphorbium	100.0	Euphorbium	100.00

¹ *Almagest. Bot.* vol. ii. p. 370.

² *Account of Morocco*, 3d edit. p. 134.

³ *Bot. of the Himalayan Mountains*, p. 328.

⁴ Gmelin, *Hand. d. Chem.*

⁵ *Bull. d. Pharm.* iv. 502.

⁶ *Ibid.*

⁷ *Gardener's Dictionary*, vol. i. art. *Euphorbium*.

⁸ *Trans. of the Linn. Soc.* vol. xiv.

⁹ *Op. cit.*

¹⁰ *Ann. Chim.* lxxviii. 44.

¹¹ Gmelin, *op. cit.*

¹² Christison, *Treatise on Poisons*.

RESIN is the active ingredient of euphorbium. It coincides in many of its properties with ordinary resins; thus, it is reddish-brown, hard, brittle, fusible, soluble in alcohol, ether, and oil of turpentine, and somewhat less so in oil of almonds. Its leading and characteristic property is intense acidity. It differs from some resins in being slightly soluble only in alkalies. It is a compound of two resinous substances.

a. One resinous substance is soluble in cold alcohol. Its formula, according to Mr. Johnston,¹ is $C^{40}H^{51}O^6$.

β. The other resinous substance is insoluble in cold alcohol. The mean of Rose's analyses² of it gives as the composition of this resin, carbon 81.58, hydrogen 11.35, and oxygen 7.07.

PHYSIOLOGICAL EFFECTS. α. *On Animals generally.*—Euphorbium acts on horses and dogs as a powerful acrid substance, irritating and inflaming parts with which it is placed in contact, and affecting the nervous system. When swallowed in large quantities, it causes gastro-enteritis (two ounces are sufficient to kill a horse); when applied to the skin, it acts as a rubefacient and epispastic. Farriers sometimes employ it, as a substitute for cantharides, for blistering horses, but cautious and well-informed veterinarians are opposed to its use.

β. *On Man.*—The leading effect of euphorbium on man is that of a most violent acrid, but under certain circumstances a narcotic operation has been observed. When *euphorbium dust is inhaled, and also applied to the face*, as in grinding this drug, it causes sneezing, redness, and swelling of the face, and great irritation about the eyes and nose. To prevent as much as possible these effects, various contrivances are adopted by different drug-grinders; some employ masks with glass eyes, others apply wet sponge to the nose and face, while some cover the face with crape. The pain and irritation, I am informed, are sometimes very great. Individuals who have been exposed for some time to the influence of this dust, suffer with headache, giddiness, and ultimately become delirious. All the workmen of whom I have inquired (and they comprise those of three large firms, including the one alluded to by Dr. Christison) agree that these are the effects of euphorbium. An old labourer assured me that this substance produced in him a feeling of intoxication; and I was informed at one drug-mill of an Irish labourer who was made temporarily insane by it, and who, during the fit, insisted on saying his prayers at the tail of the mill-horse.

Insensibility and convulsions have been produced by euphorbium. The only instance I am acquainted with is the following: A man was engaged at a mill where euphorbium was being ground, and remained in the room longer than was considered prudent. Suddenly he darted from the mill-room, and ran with great velocity down two pairs of stairs. On arriving at the ground-floor or yard he became insensible, and fell. Within five minutes I saw him: he was lying on his back, insensible and convulsed; his face was red and swollen, his pulse frequent and full, and his skin very hot. I bled him, and within half an hour he became quite sensible, but complained of great headache. He had no recollection of his flight down stairs, which seems to have been performed in a fit of delirium.

When *powdered euphorbium is applied to the skin*, it causes itching, pain, and inflammation, succeeded by vesication.

When *swallowed*, it causes vomiting and purging, and, in large doses, gastro-enteritis, with irregular hurried pulse and cold perspirations.

USES.—Notwithstanding that it is still retained in the Pharmacopœia, it is rarely employed in medicine. It was formerly used as an *emetic* and *drastic purgative* in dropsies, but the violence and danger of its operation have led to its disuse. Sometimes it is employed as an *errhine* in chronic affections of the eyes, ears, or brain; but its local action is so violent that we can only apply it when largely diluted with some mild powder, as starch or flour.

Mixed with turpentine or Burgundy pitch (or rosin), it is employed in the form of plaster, as a *rubefacient*, in chronic affections of the joints. As a *vesicant*, it is rarely employed. As a *caustic*, either the powder or alcoholic tincture (*Tinctura Euphorbiæ*, Cod. Hamb., prepared by digesting euphorbium ʒj, in rectified spirit ʒbj) is sometimes employed in carious ulcers.

¹ Phil. Trans. 1810, p. 365.

² Poggendorff's *Annalen*, xxxiii. 52.

ANTIDOTE.—In a case of poisoning by euphorbium, emollient and demulcent drinks, clysters (of mucilaginous, amylaceous, or oleaginous liquids), and opium, should be exhibited, and blood-letting and warm baths employed. In fact, as we have no chemical antidote, our object is to involve the poison in demulcents, to diminish the sensibility of the living part by opium, and to obviate the inflammation by blood-letting and the warm bath. If the circulation fail, ammonia and brandy will be required.

127. *Euphorbia Lathyris*, Linn.—Caper Spurge.

(Semina.)

This is an indigenous or naturalized biennial plant, which is cultivated in gardens. *Stem* solitary, erect, 2 or 3 feet high, purplish, round, smooth, like every other part. *Leaves* numerous, spreading in 4 rows, opposite, sessile, oblong, acute, entire, of a dark glaucous green; their base heartshaped: the lower ones gradually diminishing. *Umbel* solitary, terminal large, or 4 repeatedly forked branches. *Bracts* heartshaped, entire, tapering to a point. *Flowers* sessile in each fork, solitary, variegated with yellow and dark purple. *Nectaries* rounded with blunt horns. *Capsules* large, smooth (Smith).—The seeds (*sem. euphorbiæ lathyris*; *sem. cataputiæ minoris*; *grana regia minoris*) are about the size of peppercorns. They yielded Soubeiran¹ a yellow fixed oil, stearine, a brown acrid oil, a crystalline matter, a brown resin, an extractive colouring matter, and vegetable albumen. The yellow fixed oil is purgative, but it owes this property to matters which it holds in solution. The brown acrid oil is the active principle: it has a disagreeable odour, approaching that of croton oil, and readily dissolves in alcohol and ether. Oil of caper spurge (*oleum euphorbiæ lathyris*) may be obtained by expression, by alcohol, or by ether. The expressed oil, unlike that of croton oil, is insoluble in alcohol. It is less active than the oil prepared by alcohol (as 3 is to 2). Both the milky juice of the plant and the seeds are acrid, and violently purgative. In a case of poisoning by the seeds, narcotic symptoms also were present.² The oil may be employed as an indigenous substitute for croton oil. The dose of it is from three to ten drops.³ The capsules are pickled and used as a substitute for capers, which they resemble in size, appearance, and pungency. When recent, they are certainly acrid and poisonous; and it is probable, therefore, that the pickling process lessens or destroys their virulence; but the free use of the pickled fruits is dangerous.

128. *Euphorbia Ipecacuanha*, Linn.—Ipecacuanha Spurge.

(Radix.)

This plant (also called *American Iperacuinha*) is a native of the United States of America. The dried root (*radix euphorbiæ ipecacuanhæ*; vel *rad. ipecacuanhæ spuria alba*) is cylindrical, grayish yellow, inodorous, and has a sweetish, not unpleasant taste. According to Dr. Bigelow, it contains caoutchouc, resin, gum, and probably starch. Its active principle is perhaps resin. This root is "an energetic, tolerably certain emetic, rather milder than *E. corollata*, but, like that, disposed to act upon the bowels, and liable, if given in over doses, to produce excessive nausea and vomiting, general prostration, and alarming hypercatharsis. It is, therefore, wholly unfit to supersede ipecacuanha."⁴ The dose of the powdered root is from ten to fifteen grains. In small doses it is diaphoretic.

TRIBE. CROTONEÆ, Blume.

Ovule solitary. *Flowers* usually having petals, in clusters, spikes, racemes, or panicles.

129. *CROTON TIGLIUM*, Lam.—THE PURGING CROTON.

Croton Jamalgota, Hamilton.

Sec. Syst. Monœcia, Monadelphina.

(Oleum e semine expressum, L.—Expressed Oil of the Seeds, E. D. [U. S.])

HISTORY.—Croton seeds are mentioned by Avicenna⁵ and by Serapion⁶ under the name of *Dend* or *Dende*. The earliest European describer of them is Christopher

¹ Journ. de Pharm. t. xv. p. 507, 1829; also Nouveau Traité de Pharmacie, t. ii.

² Christison, Treatise on Poisons.

³ Dierbach, New-son Entl. in d. Mat. Med. S. 76, 1837; Bailly, Lancet, June 10th, 1826.

⁴ United States Dispensatory.

Lib. ii. cap. 219.

⁶ De Simplicibus, cccxlviii.

d'Acosta, in 1578,¹ who terms them *pini nuclei molucani*. When Commeline wrote, they were known in the shops by the name of *cataputia minor*, although they were sold by itinerants as *grana dilla* or *grana tilli*. They were much employed by medical men in the 17th century, and were known by various names, but principally by that of *grana tiglia*. They, however, went out of use, probably in consequence of the violence and uncertainty of their operation. Their re-employment in modern practice is owing partly to the notices of them by Dr. White and Mr. Marshall, in the first edition of Dr. Ainslie's work;² but principally to the introduction of the oil, in 1820, by Dr. Conwell.³

BOTANY. Gen. Char.—Flowers monoëcious, or very rarely diëcious. *Calyx* 5-parted. **MALES:** *petals* 5; *stamens* 10 or more, distinct. **FEMALES:** *petals* 0; *styles* 3, divided into two or more partitions. *Capsule* tricoëcous [with one seed in each cell] (Adr. de Jussieu).

Sp. Char.—Arboreous. *Leaves* oblong-ovate, acuminate, 3—5-nerved, slightly serrate, smooth. *Stamina* 15, distinct. Each cell of the fruit filled by the seed.

A middle-sized tree, from 15 to 20 feet high. *Bark* smooth, ash-coloured. *Leaves* thin and membranous, sometimes cordate, and with two flat round glands at their base; when young, covered on both surfaces, but especially the lower one with minute stellate hairs. At the base of the leaves are two flat round glands. *Raceme* terminal, erect, simple. *Petals* of male flower white.

Hab.—Continent of India, islands forming the Indian Archipelago, and Ceylon.

The CROTON PAVANA⁴ is said also to yield tiglium or croton seeds. It is distinguished from *C. Tiglium* by having only ten stamina, and by the seeds being much smaller than the cells in which they are placed. *C. Pavana* is a native of Ava, north-eastern parts of Bengal? Amboyna?? Dr. Hamilton thinks it is the *Granum Moluccum* of Rumphius.

DESCRIPTION.—*Croton seeds* (*semina tiglii* seu *semina crotonis*, *grana tiglii*, *purg-ing nuts* of some authors) in size and shape are very similar to castor seeds. Viewed laterally, their shape is oval or oval-oblong; seen from either extremity, they have a rounded or imperfectly quadrangular form. Their length does not exceed 6 lines, their thickness is $2\frac{1}{2}$ to 3 lines, their breadth 3 or 4 lines. Sometimes the surface of the seeds is yellowish, owing to the presence of an investing lamina (epidermis?). The testa is dark brown or blackish, and is marked with the ramifications of the raphé. The endocarp, or internal seed-coat, is thin, brittle, and of a light colour. It encloses a yellowish oily albumen, which envelops the embryo, whose cotyledons are foliaceous or membranous. The seeds are without odour; their taste is at first mild and oleaginous, afterwards acrid and burning. When heated, they evolve an acrid vapour. The proportion of shell and kernel in 100 parts by weight of the seeds is thus stated by two authorities:—

	Nimmo.	Caventou.
Shell or seed-coats	36	33.3
Kernel or nucleus	64	66.6
	100	99.9

COMPOSITION.—Croton seeds were analyzed in 1818 by MM. Pelletier and Caventou,⁵ in 1822 by Dr. Nimmo,⁶ and in 1823 by Brandes.⁷ The following are their results:—

¹ Clusius, *Exoticor.* p. 292.

² *Materia Medica of Hindostan.* 1813.

³ See his *Récherch. sur les Propr. Méd. et l'Emploi en Méd. de l'Huile de Croton Tiglium.* 1824.—For further historical details, consult Prof. H. H. Wilson's paper in the *Transactions of the Med. and Phys. Society of Calcutta*, vol. i. p. 249.

⁴ Hamilton, *Trans. Linn. Soc.* vol. xiv. 257.

⁵ *Journ. de Pharm.* t. iv. p. 289, 1818; and t. xi. p. 10, 1825. In the first paper, croton seeds were, by mistake, said to be the seeds of *Jatropha Curcas*. Caventou corrected this statement in the second paper. In the *Journ. de Pharm. et de Chim.* for March 1850, M. Guibourt states that he has recently ascertained that the seeds of *J. Curcas* are sold by respectable dealers in Paris for croton seeds. It is stated by Mr. Frost (*Lond. Medic. Reposit.* vol. xvii. p. 461, 1822; and vol. xviii. p. 474, 1822) that in England, the former seeds have been mistaken for the latter.

⁶ *Quarterly Journal of Science*, vol. xiii. p. 62, 1822. Soubeiran (*Journ. de Pharm.* t. xv. p. 514, 1829) states, though I know not on what authority, that the oil which Dr. Nimmo analyzed under the name of croton oil, was extracted from the *Jatropha*.

⁷ *Archiv der Apothekerwissenschaften im nordl. Deutschland.* Bd. iv. (quoted by L. Gmelin, *Handb. d. Chem.* ii. 1320). See also *Berlin Jahrb. für d. Pharm.* Bd. xxvi. Abt. i. S. 222, 1821.

Pelletier & Caventou.	Nimmo.	Brandes.
Fixed oil and crotonic acid . . . 50	Acrid purgative principle . . . 27	Volatile oil . . . traces
Gum 50	Fixed oil . . . 33	Fixed oil, with crotonic acid, and an alkaloid (<i>crotonin</i>) . . . 17.46
Albumen (emulsin) . . . 50	Farinaceous matter . . . 40	<i>Crotonates</i> and colouring matter . . . 0.32
Lignin 50		Brownish yellow resin, insoluble in ether . . . 1.00
		Stearine and wax . . . 0.65
		Extractive sugar, and malates of potash and lime . . . 2.65
		Starchy matter, with phosphate of lime and magnesia . . . 5.71
		Gum and gummoir . . . 10.47
		Albumen 1.01
		Gluten 2.00
		Seed-coats and woody fibre of the nucleus . . . 39.00
		Water 23.50
Kernel . . . 100	Kernel . . . 100	Croton seeds . . . 104.41

1. **VOLATILE OIL OF CROTON SEEDS.**—This is but imperfectly known, traces only of it having been obtained. Brandes regards it as extremely acrid, and thinks that by the united agencies of air and water it is converted into crotonic acid; for the distilled water of the seeds becomes more acid by keeping.

2. **FIXED OIL OF CROTON SEEDS.**—This also is but imperfectly known. It must not be confounded with croton oil of the shops, which is a mixture of this and other constituents of the seeds. Fixed oil of croton seeds is, probably, a combination of crotonic and other fatty acids with glycerine.

3. **CROTONIC ACID.** (*Jatrophic Acid*).—Discovered by Pelletier and Caventou. Though this acid exists in the free state in the seed, yet an additional quantity of it is obtained when the oil is saponified. For this purpose the oil is saponified by potash, the resulting soap decomposed by tartaric acid, and the watery fluid, from the surface of which the separated common fatty acids have been removed, is to be submitted to distillation. In this way is obtained an aqueous solution of a solid, very volatile, fatty acid, which congeals at 23° F., and, when heated a few degrees above 32° F., is converted into vapour, having a strong nauseous odour, and which irritates the eyes and nose, and has an acrid taste.

At first Pelletier and Caventou regarded this acid as the active principle of the oil; but Caventou subsequently expressed doubts on the subject, and stated that fresh experiments induced him to think that the irritating and volatile principle of the oil, and which so strongly irritated the nose and eyes, is not of an acid nature. My colleague, Mr. Redwood, informs me that he has ascertained that crotonic acid and the crotonates are inert, or nearly so; and in experiments with crotonic acid prepared by him support his statements.

Crotonic acid unites with bases forming a class of salts called *crotonates*, which are colorless. The *crotonate of ammonia* precipitates the salts of lead, copper, and silver, white; and the sulphate of iron, yellow. *Crotonate of potash* is crystalline, and dissolves, with difficulty, in alcohol. *Crotonate of barytes* is soluble in water; but *crotonate of magnesia* is very slightly soluble only in this liquid.

4. **CROTONIN.**—The crystallizable substance which Brandes thought to be a peculiar alkaloid, and which he called *crotonin*, and which appeared to be identical with the *tiglin* of Adr. de Jussieu, has been found by Weppen¹ to be (as formerly suggested by Soubeiran²) a magnesian sap with an alkaline reaction.

5. **RESIN.**—Is brown and soft; and has a disagreeable odour, on account, doubtless, of the oil which it retains. It is soluble in alcohol, but insoluble in ether and in water. The alkalis dissolve it by separating a whitish matter. It contributes to the purgative properties of croton oil.

PHYSIOLOGICAL EFFECTS. 1. **Of the Seeds.** a. *On Animals generally.*—Croton seeds are powerful local irritants or acrids, causing inflammation in those living parts with which they are placed in contact. Orfila³ found that three drachms being introduced into the stomach of a dog, and the œsophagus tied to prevent vomiting, caused death in three hours; and on examination of the body, the alimentary canal was found to be in a state of inflammation. In another experiment, a drachm caused death under the same circumstances. A drachm, also, applied to the cellular tissue of the thigh, was equally fatal. A dose of from twenty to thirty grains of the powder of the kernel given to the horse causes, in six or eight hours, profuse watery stools, and is recommended by some veterinarians as a purgative; but the uncertainty of its operation, and the griping and debility which it occasions, are objections to its use.⁴ Lansberg⁵ found that twenty of the seeds killed a horse, by causing gastro-enteritis. The pulse was frequent, small, and soft.

β. *On Man.*—In the human subject a grain of croton seed will frequently pro-

¹ Ann. d. Chem. u. Pharm. Bd. lxx. S. 254, 1849; also Chemical Gazette, vol. vii. p. 355, 1849.

² Nouv. Traité de Pharm. t. ii. p. 103.

³ Toxicol. Gén.

⁴ Youatt, The Horse, in Library of Useful Knowledge. ⁵ Wibmer, Arzneim. u. Gifte, Bd. ii. S. 222.

duce full purgation. Mr. Marshall¹ says that this quantity, made into two pills, is about equal in power to half a drachm of jalap, or to six grains of calomel. The operation, he adds, is attended with much rumbling of the bowels; the stools are invariably watery and copious. Dr. White recommends the seeds to be torrefied, and deprived of their seed-coats, before employing them.² Dr. Wallich informed me that the labourers in the Calcutta Botanic Garden were in the habit of taking one of these seeds as a purgative, but that on one occasion this dose proved fatal.

The seed-coats, the embryo, and the albumen, have each in their turn been declared to be the seat of the acrid principle; I believe the remarks which I shall have to make with respect to the seat of the acidity of castor-oil seeds, will apply equally well to that of croton seeds.

The following is a case of poisoning by the inhalation of the dust of the seeds:—

Thomas Young, aged 31, a labourer in the East India warehouses, was brought into the London Hospital on the 8th of December, 1841, labouring under symptoms of poisoning by the inhalation of the dust of croton seeds. He had been occupied about eight hours in emptying packages of these seeds, by which he was exposed to their dust. The first ill effects observed were loss of appetite, then a burning sensation in the nose and mouth, tightness at his chest, and copious lachrymation, followed by epigastric pain. Feeling himself getting worse, he left the warehouse, but became very giddy, and fell down insensible. Medical assistance was procured, an emetic was administered, stimulants were exhibited, and he was wrapped in warm blankets. When he became sensible, he complained of his mouth being parched, and that his throat was swelling. He was then removed to the hospital. On his admission he appeared in a state of collapse, complained of burning pain at the stomach, in the throat, and in the head, and of swelling and numbness of his tongue. The epigastrium felt hot and tense, the pupils were dilated, the breathing short and hurried, the countenance distressed, pulse 85, surface cold. He stated that his tongue felt too large for his mouth, and appeared to be without feeling, and he had bitten it two or three times to ascertain whether there was any sensation in it. On examination, however, no change could be observed in the size or appearance of the tongue or parts about the mouth. Hot brandy and water were given to him, and he was put into the hot bath with evident relief. He continued in the hospital for several days, during which time he continued to improve, but still complained of epigastric pain. It deserves notice that his bowels were not acted on, and on the day following his admission several doses of castor-oil were given to him.

It would be interesting to know whether the seeds of *Croton Pavana* are equally active with those of *Croton Tiglium*; and, also, whether the seeds of both species are found in commerce.

2. *Of the Oil.* *a. On Animals generally.*—On vertebrated animals (horses, dogs, rabbits, and birds), it acts as a powerful local irritant or acrid. When taken internally, in moderate doses, it operates as a drastic purgative; in large doses, as an acrid poison, causing gastro-enteritis. Moiroud³ says, that from twenty to thirty drops of the oil are, for the horse, equal to two drops for a man; and that twelve drops injected into the veins cause alvine evacuations in a few minutes. Thirty drops administered in the same manner, have caused, according to this veterinarian, violent intestinal inflammation and speedy death. A much less quantity (three or four drops) has, according to Hertwich,⁴ terminated fatally when thrown into the veins. After death the large intestines have been found to be more inflamed than the small ones. Flies, which had eaten some sugar moistened with the oil of croton, died in three or four hours—the wings being paralyzed or immovable before death.

β. On Man.—*Rubbed on the skin* it causes rubefaction and a pustular or vesicular eruption, with sometimes an erysipelatous swelling of the surrounding parts. When rubbed into the abdomen, it sometimes, but not invariably, purges. Rayer⁵ mentions a case in which thirty-two drops rubbed upon the abdomen produced purging, large vesicles, swelling, and redness of the face, with small, prominent, white, crowded vesicles on the cheeks, lips, chin, and nose. *Applied to the eye*, it gives rise to violent burning pain, and inflammation of the eye and face. In one

¹ Ainslie, *Mat. Indica*, vol. i. p. 104.

² *Pharm. Vétér.* p. 372.

³ *Treatise on Diseases of the Skin*, by Dr. Willis, p. 367.

⁴ *Ibid.*

⁵ *Wibmer, Arzneim. u. Gifte*, Bd. ii. S. 218.

case it produced giddiness.¹ Ebeling obtained relief by the application of a solution of carbonate of potash. *Swallowed in small doses*, as of one or two drops, it usually causes an acrid burning taste in the mouth and throat, and acts as a drastic purgative, giving rise to watery stools, and frequently increasing urinary secretion. Its operation is very speedy. Frequently it causes evacuations in half an hour: yet it is somewhat uncertain. Sometimes six, eight, or even ten drops may be given at a dose without affecting the bowels. In moderate doses it is less disposed to cause vomiting or purging than some other cathartics of equal power. Mr. Iliff,² however, observes that it produces nausea and griping more frequently than has been supposed.

The following is a case of poisoning by an *excessive dose* of croton oil: A young man, aged 25, affected with severe typhoid fever, swallowed by mistake two and a half drachms of croton oil. At the end of three-quarters of an hour the skin was cold and covered with cold sweats, the pulse and action of the heart scarcely perceptible, respiration difficult; the points of the toes and fingers, the parts around the eyes and the lips, blue, as in malignant cholera; abdomen sensible to the touch; but no vomiting. In an hour and a half there were excessive and involuntary alvine evacuations, sensation of burning in the œsophagus, acute sensibility of the abdomen, skin colder, respiration and circulation difficult, the cyanosis extended over the whole body, the skin became insensible; and death occurred, with some of the symptoms of asphyxia, four hours after the poison was swallowed. No lesion was found in the gastric membrane. The intestines presented ulcerations such as are characteristic of typhus fever.³

In comparing croton oil with other violently acrid purgatives, we find it distinguished by its speedy operation, the great depression of the vascular system as well as the general feeling of debility which it produces, and by the uncertainty of its operation.

USES.—The value of croton oil as an internal remedial agent depends principally on two circumstances—first, its powerful and speedy action as a drastic cathartic, by which it is adapted for obviating constipation, or for operating on the bowels as a counter-irritant; and secondly, on the smallness of the dose, which in practice presents many advantages. These circumstances render it peculiarly applicable in cases requiring powerful and speedy catharsis, and in which the patient cannot swallow, or does so with extreme difficulty, as in *trismus*, *coma*, and *some affections of the throat*; or where he will not swallow, as in *mania*. In all such cases the oil may be dropped on the tongue. In *obstinate constipation*, whether from the poison of lead or from other causes, it has sometimes succeeded where other powerful cathartics had been tried in vain. It is especially serviceable where the stomach is irritable, and rejects more voluminous purgatives; and it is of course objectionable in all inflammatory conditions of the digestive tube. In stercoraceous vomiting, with other constitutional symptoms of hernia, but without local evidence of displacement, and where the stomach rejected the ordinary senna draught, I have known oil of croton prove most effectual. In *torpid conditions of the intestinal canal*, in *tendency to apoplexy*, in *dropsy* unconnected with inflammation, in *paralysis*—in a word, in any cases in which a powerful and speedy intestinal irritant is required, either for the purpose of evacuating the canal merely, or for acting as a revulsive or counter-irritant, and thereby relieving distant parts, croton oil is a very useful, and, on many occasions, most valuable cathartic. In employing it, two cautions are necessary: it must be avoided, or at least used with great caution, in extreme debility; and it is improper in inflammatory affections of the digestive organs. The great drawback to its use is its uncertainty. In one case it acts with extreme violence, in another it scarcely produces any effect. In the *diseases of children*, where a powerful purgative is required, croton oil has been administered, on account of the minuteness of the dose and the facility of its exhibition. In hydrocephalus, and other head

¹ Dierbach, *Neuesten Entd. in d. Mat. Med.* 1837, p. 201.

² *Lond. Med. Rep.* vol. xvii.

³ *Journ. de Chim. Méd.* 2nde sér. t. v. p. 509.

affections of children, I have several times used it where other cathartics have failed, or where extreme difficulty was experienced in inducing the patients to swallow the more ordinary remedies of this class. In some of these it has disappointed me. In the case of a child of four years of age, affected with incipient hydrocephalus, I gave six doses, of one drop each, of the oil without any effect. In *uterine obstructions* (chlorosis and amenorrhœa) it has occasionally proved serviceable. In *tape-worm* it has been recommended, but I have no experience of its efficacy.

Rubbed on the skin, croton oil has been employed to produce rubefaction and a pustular eruption, and thereby to relieve diseases of internal organs, on the principle of counter-irritation, before explained¹ (see vol. i. p. 170). *Inflammation of the mucous membrane lining the air-passages, peripneumonia, glandular swellings, rheumatism, gout, and neuralgia*, are some of the diseases against which it has been applied in this way; and doubtless frequently with benefit. It is sometimes used in the undiluted form, but more commonly with twice or thrice its volume of olive oil, oil of turpentine, soap liniment, alcohol, ether, or some other convenient vehicle. But, in all the cases just enumerated, it has never appeared to me to present any advantage over many other counter-irritants in common use—as emetic tartar; while the chance of causing purging is, in some cases, an objection to its use, and its greater cost sometimes precludes its employment on a large scale in pauper establishments. Frictions with it on the abdomen have been used to promote alvine evacuations, but it frequently fails to produce the desired effect. To promote the absorption of the oil in these cases, it should be dissolved in ether or alcohol, and the frictions are to be assiduously made.

ADMINISTRATION.—*Croton seeds* are rarely or never used in this country. Their farina may, however, be given in doses of a grain or two.

CROTONIS OLEUM, E.; Tigllii Oleum, L.; Oleum Tigllii, U.S.; Croton Oil.—This is the expressed oil of the seeds. It is imported from the East Indies, principally from Madras and Ceylon, but in part from Bombay. I have been informed by an oil-presser at Calcutta that it is prepared like castor oil, except that it is strained instead of being boiled. In shelling the seeds, the women often suffer severely with swelling of the face, &c. Croton oil is also expressed in England. The operation is usually effected by a Bramah's press in a room heated to about 75° F. The men engaged in the process are usually much affected by it; they suffer redness of the face, irritation of the eyes and air-passages, and purging. The following are the results obtained at two operations: the weights are avoirdupois:—

	Seeds.			Oil obtained.	
	cwts.	qrs.	lbs.	lbs.	
Croton Seeds	2	0	17.	. . . . .	51
Ditto	5	3	10.	. . . . .	150
Total	7	3	27.	. . . . .	201

This gives a per centage produce of about 22.46. The colour of the oil thus obtained, when viewed by transmitted light, was that of dark sherry. No use is made of the cake.

In France, the croton cake is subjected to the action of alcohol, and the oil thus obtained mixed with the previously expressed oil. Guibourt² obtained by expression 41.6 per cent. of oil from the kernels of the seeds, and subsequently 10.4 per cent. by the action of alcohol: making together 52 per cent. Calculating the shells at one-third the weight of the entire seeds, this product would be equal to nearly 35 per cent. for the entire seeds.

Genuine croton oil varies in colour from very pale yellow (like that of Canada balsam) to dark reddish-brown (like the deepest-coloured sherry). Its consistence is unctuous, and increases with age. It has an unpleasant but marked odour and

¹ *Bamb. rger, De olei crotonis externe adhibiti efficacia.* Berol. 1833.

² *Journ. de Pharm. et de Chim.* 3d ser. t. xvii. p. 183. 1850.

an acrid taste, and leaves behind an acrid sensation in the fauces. It reddens litmus, and is soluble in ether and in the fixed and volatile oils.

The following are the characteristics of the goodness of the oil according to the Edinburgh College:—

When agitated with its own volume of pure alcohol and gently heated, it separates on standing, without having undergone any apparent diminution.

This statement is not correct, according to my observations. Pure croton oil expressed in London dissolves in alcohol (sp. gr. 0.796) without requiring to be "gently heated." The oil imported from the East Indies does, however, require to be heated with the alcohol to effect its solution. In the second place, separation does not take place, at ordinary temperatures, in the case of a mixture of English croton oil and alcohol. But by a low temperature, separation takes place on standing, but in that case the volume of oil is found to be slightly augmented. East India croton oil mixed with alcohol separates by repose: the volume of the oil, however, is increased and that of the alcohol proportionately lessened.

In one experiment 8 vols. of E. I. croton oil were mixed with 8 vols. of alcohol, sp. gr. 0.796, and gently heated. In two days separation had taken place: the oil now measured $8\frac{3}{4}$ vols., and the alcohol $7\frac{1}{4}$ vols. In a second experiment, 7 vols. of another E. I. croton oil were mixed with 7 vols. of alcohol: in four days separation had taken place: the oil measured $7\frac{1}{2}$ vols., and the alcohol $6\frac{1}{2}$ vols.

According to Dr. MacLagan, only 96 per cent. of the oil separates. It is obvious, therefore, that commercial croton oils, believed to be genuine, are not uniform in their relation to alcohol.

According to Mr. Twining,¹ there are two kinds of croton oil met with in commerce. One is dark yellow and thickish, the other is straw-coloured. The first is the most energetic. These oils, he thinks, may perhaps be obtained from different plants; the one from *Croton Tiglium*, the other from *Croton Pavana*.

The croton oils found in the London market are of two kinds; one exotic, imported from India and Ceylon—the other expressed in London. These differ both in their appearance and relation to alcohol.

α. OLEUM CROTONIS EXOTICUM; Foreign or East Indian Croton Oil; Pale Croton Oil.—This is imported from Ceylon and the continent of India. It is paler than London expressed oil. Some samples are very transparent and pale yellow, like Canada balsam. Others (the more usual sort) are of a pale amber colour. If equal volumes of East India oil and alcohol (sp. gr. 0.796) be shaken together, an opake milky mixture is obtained: but, if the heat of a spirit-lamp be applied, the mixture becomes transparent and uniform. By standing, however, for twenty-four hours, it separates into two strata: the lower one consisting of the oil which has taken up a small quantity of alcohol, and has, in consequence, become somewhat augmented in bulk, and the upper one, the alcohol, which has suffered a corresponding diminution in volume (see above).

β. OLEUM CROTONIS ANGLICUM; English Croton Oil; Dark Croton Oil.—The oil expressed from croton seeds in London is darker coloured than that usually imported from India. By transmitted light it is of a reddish-brown colour, like that of the deepest sherry, almost approaching to chestnut brown. By reflected light it has a greenish tinge. The dark colour of the oil may perhaps depend on some change which the seeds have suffered by keeping. After the oil has stood for a few months it is found to have deposited some white fat (margarine?). If equal volumes of alcohol (sp. gr. 0.796) and this oil be shaken together at ordinary temperatures, they form a uniform transparent mixture, and no separation takes place on standing for many weeks, unless the mixture be exposed to a low temperature. This fact, which was mentioned to me by Mr. Redwood, he has verified with various samples of croton oil expressed respectively by himself, by Mr. Morson, by Messrs. Herrings, and by Messrs. May and Co. I have verified it with a sample expressed by Messrs. Herrings. Exposure to artificial cold (as a freezing mixture) or to the atmosphere during a very cold night will cause a separation: the oil is then found to have slightly increased in bulk, and the alcohol to have suffered a corresponding diminution of volume.

On what, it may be asked, does this difference in the properties of the East Indian and English croton oils depend? Does it arise from some difference in the mode of preparation? Or is the East Indian oil contaminated with jatropa oil?

Dr. Christison observes, that croton oil "is not easily adulterated with the com-

¹ Dierbach, *op. cit.*

mon fixed oils, with the exception of castor-oil, because this is the only common oil which possesses sufficient thickness to impart due unctuousity. Castor-oil may be detected by the test mentioned in the Edinburgh Pharmacopœia. Absolute alcohol shaken with the adulterated oil will dissolve out the impurity, and thus lessen its volume; but no visible diminution is produced on pure croton oil. Five per cent. of castor-oil may be thus detected; but the application of heat, as recommended by the College, is unnecessary." It is obvious, however, that this test is not applicable to English croton oil adulterated with castor-oil, both of which oils are soluble in the cold in alcohol.

If any fraud be practised in respect to croton oil, the adulterating ingredient is, I suspect, jatropha oil, which is less soluble in alcohol than croton oil.

Croton oil is exhibited in doses of one, two, or three drops. In some instances it is simply placed on the tongue—as in coma, tetanus, mania, &c.; or it may be taken in a teaspoonful of syrup. These methods of administering it are objectionable, on account of the acrid taste produced. The usual mode of employing it is in the form of pill, made with conserve of roses or bread-crumbs. Some have employed it in the form of emulsion, flavoured with some carminative oil or balsamic substance; but the burning of the mouth and throat to which it gives rise is an objection to its use.

α. *Tinctura Crotonis*; *Tincture of Croton*.—This is prepared by digesting the seeds, or dissolving the oil in rectified spirit. Soubeiran's formula is one drop of croton oil, and half a drachm of rectified spirit.

β. *Sapo Crotonis*; *Croton Soap*.—This is prepared with two parts of croton oil and one part of soap boiler's lye. It is, in fact, a crotonate of soda. A croton soap is sold by Mr. Morson, of Southampton Row, Russell Square. It may be used as a purgative, in doses of from one to three grains. It has been said that the alkali diminishes the acrimonious property of the oil without affecting its cathartic powers—a statement, however, which is highly improbable.

2. **LINIMENTUM CROTONIS, D.**; *Croton Liniment*.—(Croton Oil f 3i; Oil of Turpentine f 3vii. Mix them with agitation, *D.*)—A croton liniment is frequently prepared by mixing one part of croton oil with four or five parts of olive oil. Rubbed repeatedly on the skin, it occasions redness and a pustular eruption. It is used as a counter-irritant.

ANTIDOTES.—In a case of poisoning by the seeds or oil, the first object is to remove the oil from the stomach. Mild, demulcent, and emollient drinks are then to be given. Alkaline substances have been recommended as chemical antidotes, but their efficacy is not proved. Full doses of opium will be requisite to check the diarrhoea. To relieve a failing circulation, ammonia and brandy may be given, and the warm bath employed.

130. CROTON ELEUTERIA, Swartz.—THE SEA-SIDE BALSAM OR SWEET-WOOD.

Sez. Syst. Monœcia, Monadelphia.

(Cortex, *L.*—Cascarilla. Bark probably of *Croton Eleuteria*, and possibly of other species of the same genus, *E.*—The bark, *D.*)

HISTORY.—Great confusion has existed with regard both to Cascarilla or Eleuteria bark and the plant yielding it.

The bark is said to have been first noticed by Vincent-Garcias Salat,¹ a Spaniard, in 1692. In the following year, Stisser,² a German professor, gave a more extended notice of it, and states that he had some of it given him by a person of distinction,

¹ *Unica quæstioncula in quâ examinatur pulvis de quarango vulgò cascarilla in curatione tertiana*, in 4to. Valentini, 1692. (Duyal, *Journ. de Pharm. et de Chimie*, 3me ser. t. viii. p. 91, 1845: see also Alibert, *Nouv. Elém. de Thérap.* t. i. p. 74, 5me édit. 1826.)

² *Acta laboratorii chymici*, specimen ii. Helmsstädt, 1693 (quoted by Geoffroy). Stisser was the author of a letter to the Fellows of the Royal Society, entitled *De machinis fumiductoriis*, and published at Hamburgh, in 1686.

at that time just returned from England, who told him that it was then the custom in England to mix it with tobacco, in order to render it more agreeable for smoking.

By Dale¹ and some other pharmacologists, it was thought to be *cortex thuris*, or frankincense bark, and by Geoffroy² and others to be a species of cinchona bark. Its name *cascarilla* (the diminutive of *cascara*, the Spanish name for the rind or bark of trees) is also a Spanish name for Peruvian bark.

In 1754, Catesby³ noticed and figured a plant, which, he said, grew plentifully on most of the Bahama Islands, and yielded Cascarilla bark, or, as he called it, "*The Ilatheria bark, La Chacrilla*." This plant is generally supposed to be the *Croton Cascarilla*, Linn. (*C. lineare*, Jacq.); and several reasons led me, at one time,⁴ to think that it might be the source of the cascarilla bark of the shops—an opinion also entertained by Dr. Wood;⁵ but Dr. Lindley⁶ adduced several reasons for believing that the *Croton Eleuteria* was the true species, as Drs. Wright and Woodville had already asserted; and the subsequent receipt, by Dr. Lindley, of specimens of the plant, from the Hon. J. C. Lees, Chief Judge in the Bahamas, has fully confirmed the accuracy of Dr. Lindley's opinion.⁷ "The plant," says Mr. Lees, "is scarcely known here by the name of Cascarilla, but is commonly called Sweet Wood Bark, and often Eleuthera Bark, because it is chiefly gathered on the island of Eleuthera. It is the only bark receiving the name of Cascarilla exported from the Bahamas, where the tree grows in abundance."

The *Croton Cascarilla*, Don, L. (*C. Pseudo China*, Schiede), yields Copalchi (not Cascarilla) bark.

BOTANY. Gen. Char.—See *Croton Tiglium*.

Sp. Char.—A small tree; leaves ovate, obtuse, entire, beneath silvery and densely downy; racemes axillary and terminal, compound; flowers subsessile, monœcious (Lindley).

Branches and twigs angular, somewhat compressed. *Leaves* stalked, alternate, with a short but obtuse point. *Flowers* monœcious, subsessile. **MALES:** *petals* whitish; *stamens* 10—12. *Ovary* roundish; *styles* 3, bifid; *stigmas* obtuse. *Capsules* roundish, minutely warted, not much bigger than a pea, with three furrows, 3 cells, and 6 valves.⁸

Hab.—The Bahama Islands, Jamaica.

DESCRIPTION.—*Eleutheria* or *cascarilla* bark (*cortex eleuteriæ seu cascarillæ, chaquerille vel schacharilla*) is in the form of fragments, or quills, of about one or two, more rarely three or four, inches long; the fragments being thin, and usually curved both longitudinally and transversely, the quills varying in size from that of a writing pen to that of the little finger. The bark is compact, hard, moderately heavy, and has a short resinous fracture, not fibrous or splintery, as in cinchona bark. Some of the pieces are partially or wholly covered with a whitish rugous epidermis, cracked both longitudinally and transversely. If a longitudinal section of the bark be examined by the microscope, cells are observed filled with an orange-red matter (oleo-resin?). The cortical layers are of a dull brown colour. The taste of this bark is warm, spicy, and bitter; its odour is peculiar, but agreeable. When burned, it evolves a pleasant odour (which has been compared by Pfaff to that of vanilla or amber when heated), on which account it is a constituent of *fumigating pastiles*.

Fée⁹ has enumerated no less than forty-three species of lichens found on this bark. With one exception (*Parmelia perlata*, which I have never seen on cascarilla), every one of these lichens has an adherent, crustaceous, amorphous thallus.

¹ *Pharmacologia*, 3tia ed. p. 346, 1737. Many of the synonymes for this bark given in Dale's work are erroneous.

² *Treat. on Foreign Vegetables*, by R. Thicknesse, M. D. (chiefly taken from Geoffroy), Lond. 1749.

³ *Nat. Hist. of Carolina, Florida, and the Bahama Islands*.

⁴ See *Lond. Med. Gaz.* vol. xx. p. 4-9.

⁵ *Fl. Med.* p. 179.

⁶ Specimens of the stems and bark accompanied the specimens of the plant. The former were kindly presented to me by Dr. Lindley.

⁸ Swartz, *Fl. Ind. occ.*

⁹ *United States Dispensatory*.

⁹ *Essai sur Cryptogames*. 1:24.

A very common species is *Lecidea Arthonioides*, Fée; the thallus of which is very white, and the apothecia minute, round, and black.

COMMERCE.—It is imported from Nassau, in New Providence (one of the Bahama Islands).

COMPOSITION.—Cascarilla bark was analyzed by Trommsdorff,¹ who obtained from it the following substances: Volatile oil 1.6, bitter resin 15.1, gum and bitter matter with trace of chloride of potassium 18.7, woody fibre, 65.6. Meissner² detected in the ashes of the bark the oxide of copper. Brandes³ has announced the existence of a peculiar alkaline substance (*cascarillina*).

1. VOLATILE OIL OF CASCARILLA (*Oleum Cascarillæ*).—It possesses the odour and taste of the bark. Its sp. gr. is 0.938. Its colour is variable, sometimes being greenish, at others yellow or blue. It consists of two oils, one boiling at 344°, and which contains no oxygen (its formula probably being C¹⁰H⁸); the other less volatile and oxygenated. Nitric acid converts it into a yellow, pleasant smelling resin. By distillation with water the bark yields about 1-120th of its weight of this oil.

2. RESIN.—Separated from the alcoholic tincture of the cascarilla by the addition of water. It is reddish brown; has a balsamic, slightly bitter, not astringent taste; and, when thrown on hot coals, evolves an agreeable odour.

3. EXTRACTIVE.—Has a bitter, but not balsamic taste. Its watery solution reddens litmus, and is unchanged by either ferruginous solutions or tincture of nutgalls.

CHEMICAL CHARACTERISTICS.—The sesquichloride of iron deepens the colour of the infusion of cascarilla. The tincture of nutgalls causes turbidness, and at the end of twenty-four hours a very slight precipitate. A very concentrated alcoholic tincture deposits some resin on the addition of water.

PHYSIOLOGICAL EFFECTS.—Cascarilla bark belongs to the *aromatic bitters*, before noticed (see *ante*, p. 244): that is, it produces the combined effect of an aromatic and of a moderately powerful tonic; but it does not possess any astringency. Some pharmacologists place it with aromatics, others with tonics. Cullen,⁴ though at one time uncertain as to which of these classes it belonged, ultimately classed it with the tonics. Krauss⁵ states that moderate doses give rise, in very susceptible, especially in sanguine subjects, to narcotic effects; but though I have frequently employed it, I never observed an effect of this kind. Mixed with tobacco, and used for smoking, it is said to cause giddiness and intoxication.⁶

USES.—Cascarilla has been employed as a substitute for cinchona; and although it is inferior to the latter in tonic and febrifuge qualities, its aromatic quality frequently enables it to sit easily on the stomach, without causing either vomiting or purging, which, in irritable affections of the alimentary canal, cinchona is apt to produce. In this country it is principally employed in those forms of dyspepsia requiring an aromatic stimulant and tonic. It is also used in cases of debility generally; and in chronic bronchial affections, to check excessive secretion of mucus. In Germany, where it is a favourite remedy, it is used in many other cases; such as low nervous fevers, intermittents, the latter stages of diarrhoea, and dysentery.

ADMINISTRATION.—The powder may be given in doses of from ten grains to half a drachm; but it is a less agreeable form than the infusion.

1. INFUSUM CASCARILLÆ, L. E. D.; *Infusion of Cascarilla*.—(Cascarilla Bark, bruised, \mathfrak{z} iss [\mathfrak{z} j, *D.*]; Boiling [distilled, *L.*] Water Oj [Oss, *D.*]. Macerate for two [one, *D.*] hours in a vessel lightly covered, and strain [through linen or calico, *E.*]. The product should measure about eight ounces, *D.*)—A light and aromatic bitter tonic. It is a good vehicle for acids and alkalies. The tincture of cascarilla is usually joined with it. Dose, from $\mathfrak{f}\mathfrak{z}$ j to $\mathfrak{f}\mathfrak{z}$ ij.

2. TINCTURA CASCARILLÆ, L. E. D.; *Tincture of Cascarilla*.—(Cascarilla Bark, bruised [in moderately fine powder, *E.*], \mathfrak{z} v; Proof Spirit Oij. Macerate for seven [fourteen, *D.*] days, then express and filter, *L.* “Proceed by percolation or diges-

¹ Gmelin, *Handb. d. Chem.* ii 1319.

² *Berl. Jahrb.* xxiii.

³ *Heilmittellehre*, S. 401.

⁴ *Ibid.*

⁵ *Mat. Med.*

⁶ *United States Dispensatory*.

tion, as afterwards directed for tincture of cinchona," *E.*)—Generally employed as an adjunct to tonic and stomachic infusions. Dose, from fʒj to fʒij.

131. *Croton Pseudo-China*, Schlectendal.—Copalche Bush.

(Cortex Copalche vel Copalchi.)

CROTON PSEUDO-CHINA, Schlectendal, Berlin, Jahrb. f. d. Pharmacie, 1829, p. 1 (with a figure); Linnæa, Bd. v. S. 84, 1830; and Bd. vi. S. 359, 1831.—*Croton Cascarilla*, Don, Ed. New Phil. Journ. vol. xvi. p. 368.

This species of *Croton* was discovered by Schiede (Linnæa, Bl. iv. S. 211, and 579, 1829) between Plan del Rio and Puente in Mexico. A small variety (*C. Pseudo-China* var. *minor*) was found between Laguna Verde and Actopan. Both plants yield a bark very similar to that of cascarilla, and which is called in the apothecaries' shops of Jalapa *quina blanca* or *copalche*.

According to v. Bergen and v. Santen four serons of this bark were imported in 1817 into Hamburg from Cuba under the name of *cascarilla de Trinidad*. In 1827, more than 30,000 lbs. of it came along with cinchona bark from Peru to Hamburg, by way of Liverpool. Of this, 32 serons were shipped at Payta and 300 serons at Guayaquil. It was said to be a *cinchona* under the name of *copalchi* (*quina dit copalchi*). The Prussian Minister, v. Altenstein, received it from Mexico under the name of *copalche*.¹ In 1825, Mercadieu² published an analysis of it; and stated that it was known in Mexico as *copalchi* or *cortex amarus*. He showed a sample of it to Humboldt, who suggested that it might be the produce of *Croton suberosum*, HBK.

I have met with two sorts of copalche bark in English commerce:—

1. *Quilled Copalche*.—Under the name of a *new kind of cinchona bark* I received copalche bark in the form of small thin quills, which in shape, size, and general appearance, resemble that kind of cinchona bark called by druggists "ash cinchona." In flavour, it closely resembles cascarilla bark; and in burning evolves a similar odour. It is the kind figured by Göbel and Kunze, and is doubtless the sort which the late Mr. Don mistook for genuine cascarilla bark. It might with propriety be called *Mexican cascarilla*. From genuine or Bahama cascarilla it is distinguished by the length of the quills, their colour, and the absence of transverse cracks.

2. *Corky Copalche Bark*.—Under the name of *copalche* or *chiquique bark*, I have received a bark in coarser larger quills and twisted pieces covered with a very thick and much cracked corky coat. Its taste is very bitter. In burning, it evolves an aromatic odour. Is this the produce of *Croton suberosum*? Dr. Stark³ states that he received it from Chili under the name of *nutri*; and that at Santa Cruz it is known as *chiquique*.

Copalche bark has been analyzed both by Mercadieu and Brandes. According to the latter chemist, 100 parts of the bark yield a *yellow bitter extractive with malates* 13.3, *brown tasteless extractive* obtained by potash 3.3, *acid aromatic soft resin* 6.3, *green resin* 1.0, *semi-resin* 8.3, *fat with green resin* 1.1, *wax with malate of lime* 0.7, *glutinous nitrogenous matter* 33.3, *albumen* 8.7, *malate of lime* 3.3, *oxalate of lime* 4.1, *phosphate of lime* 1.4, *sulphates and muriates* 0.7, *ligneous fibre* 18.0, *loss in water and volatile oil* 6.2.

The medicinal properties of copalche resemble those of cascarilla bark. In Mexico it is used as a substitute for cinchona in the treatment of intermittents. It may be exhibited in powder, infusion, decoction, tincture, or spirituous extract, in the same doses as cascarilla. Dr. Stark says the infusion or decoction is best made by half an ounce of bark to a pint of water: the dose being a tablespoonful or small wineglassful. The tincture he prepares with an ounce of bark to one pint of proof spirit; the dose being one or two teaspoonfuls.

132. *RICINUS COMMUNIS*, Linn.—THE CASTOR-OIL PLANT, OR PALMA CHRISTI.

Sex. Syst. Monœcia, Monadelphia.

(*Oleum e semine calore aut vi comparatum*. *L.*—Expressed oil of the seeds, *E.*—The seeds from which the oil is expressed; *Oleum ricini*, *D.* [*U. S.*])

HISTORY.—The castor-oil plant was known in the most ancient times. Caillaud found the seeds of it in some Egyptian sarcophagi, supposed to have been at least 4000 years old.⁴ Whether this is, as some persons imagine,⁵ the plant called *kikayon* in the Bible,⁶ and which, in our translation, is termed the *gourd*, I cannot pretend to decide. The pious fathers, Jerome and Augustin, differed so much in

¹ Martiny, *Encyclop. d. med.-pharm. Naturation- und Rohrwarenkunde*, Bd. i. 1843; also, Göbel and Kunze, *Pharmac.-ut. Warenkunde*.

² *Journ. de Chimie Méd.* t. i. p. 236 bis, 1825.

³ *Pharmaceutical Journal*, vol. ix. p. 463, April, 1850.

⁴ *Dict. Univ. de Mat. Méd.* t. vi.

⁵ See Dr. Canvane's *Dissertation on the Oleum Palma Christi*, 2d edit. Lond. 1769.

⁶ *Jonah*, iv. 6.

their opinions as to what was the particular plant meant in the passage just referred to, that from words we are told, they proceeded to blows!'

The ancient Greeks were acquainted with the *ricinus*, for both Herodotus² and Hippocrates³ mention it; the latter employed the root in medicine. Dioscorides⁴ calls it the *ξιχι* or *χρότων*. It was termed *χρότων* by the Greeks, and *ricinus* by the Romans,⁵ on account of the resemblance of its seeds to a little insect bearing these names, which infest dogs and other animals, and whose common name in English is the *tick*.

BOTANY. **Gen. Char.** — *Flowers* monœcious. *Calyx* 3—5-parted, valvate. *Petals* 0. *Filaments* numerous, unequally polyadelphous; cells of the *anther* distinct, below the apex of the filament. *Style* short; *stigmas* 3, deeply bipartite, oblong, coloured, feathery; *ovary* globose, 3-celled, with an ovule in each cell. *Fruit* generally prickly, capsular, 3-coccous, with 1 seed in each cell.—*Trees, shrubs, or herbaceous plants*, sometimes becoming arborescent. *Leaves* alternate, palmate, peltate, with glands at the apex of the petiole. *Flowers* in terminal panicles, the lower male, the upper female; all articulated with their peduncles, and sometimes augmented by bi-glandular bracts (Lindley, from Endlicher).

Sp. Char.—*Stem* herbaceous, pruinose. *Leaves* peltato-palmate, in 7 lobes; the lobes ovate acuminate, serrated. *Flowers* in long glaucous racemes. *Stigmas* 3, bifid at the apex. *Capsule* covered with spines.

The *stems* of plants growing in this country are round, greenish or reddish-brown, and blue pruinose, and branched. *Leaves* on long round petioles, 8- or 10-lobed. A large scutelliform gland on the petiole, near its junction with the lamina. *Filaments* capillary, branched. *Stigmas* reddish. *Capsules* supported on stalks, which are somewhat longer than the capsules themselves.

Hab.—India. When cultivated in Great Britain, *Ricinus communis* is an annual, seldom exceeding three or four feet high; but in other parts of the world it is said to be perennial, arborescent, and to attain a height of fifteen or twenty feet. Dr. Roxburgh⁶ says that in India several varieties are cultivated, "some of them growing to the size of a pretty large tree, and of many years' duration." Clusius⁷ saw it in Spain with a branch-

Fig. 296.

*Ricinus communis.*

a. Stamens. b. Anther. c. Stigmas. d. Capsule. e. Seed. f. Embryo.

¹ Harris, *Nat. Hist. of the Bible*; also Kitto's *Cyclopædia of Biblical Literature*, vol. ii. p. 203, art. *Kikayon*.

² *Ibid.* ii. *Euterpe*, 94.

³ *Ibid.* iv. cap. 161.

⁴ *Fl. Indica*, vol. iii. p. 689.

⁵ *De Nat. Mulieb.* p. 573, ed. Fries.

⁶ *Pliny, Hist. Nat. lib. xv. cap. 7.*

⁷ *Eroticorum*, p. 299.

ed trunk as thick as a man's body, and of the height of three men. Belon¹ also tells us that in Crete it endures for many years, and requires the use of ladders to mount it. Ray² found it in Sicily as large as our common alder trees, woody, and long-lived; but it has been a question with botanists whether these arborescent and other kinds are mere varieties of, or distinct species from, the ordinary *Ricinus communis*.

The following (varieties or distinct species) are enumerated by Nees and Ebermaier³ as common in gardens, and as distinguished principally by the colour and pruinose condition of the stem—characters which, however uncertain in other cases, appear here to be constant.

1. *RICINUS AFRICANUS* (Willd.).—Stem not pruinose, green, or on one side reddish. The fruit-racemes abbreviated, the fruit-stalk longer than the capsule. Seeds attenuated on one side, marbled gray and yellowish-brown. [Arborescent. Cultivated in Bengal.]

2. *RICINUS MACROPHYLLUS* (H. Berol.).—Nearly allied to the foregoing: stem quite green, not pruinose. Fruit-racemes elongated, fruit-stalk shorter than the fruit.

3. *RICINUS LEUCOCARPUS* (H. Berol.).—Stem pale green, white pruinose. Fruit stalk as long as the fruit. The unripe fruit and prickles almost quite white.

4. *RICINUS LIVIDUS* (Willd.).—Stem, petiole, midrib purple red, not pruinose. Nearly allied to *R. africanus*, and, like this, more woody and perennial. [Arborescent. Cultivated in Bengal (Hamilton).]

5. *RICINUS VIRIDIS* (Willd.).—Stem pale green, blue pruinose, by which it is distinguished from *R. macrophyllus*. Seed somewhat smaller, more oval, marked with white and fine brown. [Herbaceous. Cultivated in Bengal (Hamilton).]

DESCRIPTION.—*Castor seeds* (*semina ricini* seu *sem. cataputiae majoris*) are oval, somewhat compressed, about four lines long, three lines broad, and a line and a half thick; externally they are pale gray, but marbled with yellowish-brown spots and stripes. The seed-coats consist, according to Bischoff,⁵ of a smooth external coat (*epidermis seminalis*). 2dly, a difform, hard *testa*, consisting of two layers—an external thick and dark brown one, and an internal one, thinner and paler. 3dly, a *cuticula nuclei* or *membrana interna*. The fleshy tumid *cicatricula stomatis* (also termed *strophiola*) is very evident at the upper end of the seed; beneath it is a small *hilum*, from which passes downwards the longitudinal *raphé*.⁶ The *chalaza* is colourless.⁷ The *nucleus* of the seed consists of oily *albumen* and an *embryo*, whose cotyledons are membranous or foliaceous.

COMPOSITION.—The only analysis of these seeds, as yet published, is that of Geiger.⁸ The following are his results:—

a. Seed coats	{ Tasteless resin and extractive	1.91	}	23.82
	{ Brown gum	1.91		
b. Nucleus of the seeds	{ Ligneous fibre	20.00	}	69.09
	{ Fatty oil	46.19		
	{ Gum	2.40		
	{ Casein (albumen)	0.50		
	{ Ligneous fibre with starch? (hardened albumen?)	20.00		
Loss (moisture)				7.09
Castor seeds				100.00

1. **VOLATILE ACRID PRINCIPLE** (? *ricinoleic acid*).—This principle is not mentioned by Geiger, and its existence has been doubted or denied by others. But the following as well as other facts establish, in my opinion, its presence: First, Guibourt⁹ experienced a peculiar feeling of dryness of the eyes and throat, in consequence of having been exposed to the vapour arising from a vessel in which bruised castor seeds and water were boiling. Secondly, Planché obtained a permanent odorous principle by distilling a mixture of water and castor-oil. Bussy and Lecanu¹⁰ ascribe the occasional acidity of the oil to the production of fatty acids, by the action of the air on it.

2. **FIXED OIL**.—(See *Oleum Ricini*.)

3. **ACRID RESIN?**—Castor seed appear to contain a fixed acrid principle, probably of a resinous nature, as suggested by Soubeiran.¹¹ The acrid principle (whatever its nature may be) appears to reside in both the *albumen* and *embryo* of the seeds. Jussieu¹² and some others have asserted that it resided exclusively in the embryo; while Boutron-Charlard and Henry, jun.¹³ declared the albumen to be the exclusive seat of it. But any unprejudiced person may soon

¹ *Observ. lib. i. cap. 18.*

² *Handb. d. med.-pharm. Botan.*

³ *Handb. d. bot. Term.* pp. 508, 510, and 512, tab. xl. fig. 1875.

⁴ Bischoff, *Ibid.* p. 515, &c. tab. xli. fig. 1747.

⁵ *Handb. d. Pharm.* Bd. ii. S. 1871.

⁶ *Journ. de Pharm.* t. xiii. p. 80.

⁷ Quoted by De Candolle, *Essai sur les Propr. des Plantes*, p. 263.

⁸ *Journ. de Pharm.* t. x. p. 466.

⁹ *Hist. Plant.* vol. i. p. 166.

¹⁰ Hamilton, *Linn. Trans.* vol. xiv.

¹¹ *Ibid.* p. 518, tab. xliiii. fig. 1901.

¹² *Journ. de Chim. Méd.* t. i. p. 111.

¹³ *Ibid.* t. xv. p. 507, 1829.

satisfy himself, by tasting separately the embryo and albumen, that both parts possess acridity. Dierbach¹ states that in fresh seeds the innermost seed-coat contains the acrid principle. If this be correct, it is most remarkable that the same coat, when dry, contains none.

Calloud² found that castor cake (the residual cake left after the expression of the oil from the seeds), after having been deprived of all its principles soluble in alcohol, still contains an acrid principle, and excites vomiting when given in doses of about $7\frac{1}{2}$ grains.

PHYSIOLOGICAL EFFECTS.—Castor seeds possess considerable acridity. Bergius³ states that a man masticated a single seed at bedtime: the following morning he was attacked with violent vomiting and purging, which continued the whole day. Lanzoni also states that the life of a woman was endangered by eating three grains of the seeds.⁴ More recently, a girl, 18 years of age, was killed by eating "about twenty" seeds: the cause of death was gastro-enteritis.⁵

OLEUM RICINI, L. E. D.; Castor-Oil.—This may be obtained from the seeds by expression, by decoction, or by the agency of alcohol. The chief part, if not the whole of the oil consumed in England, whether imported or extracted in England, is procured by expression.

Soubéiran⁶ considers all processes in which heat is employed as objectionable, as a quantity of fatty acids is produced which renders the oil acrid. In America, on the contrary, heat is considered useful by expelling a volatile acrid principle.⁷ It cannot be doubted but that too high a temperature develops acrid matter. In England, the oil is expressed, either by Bramah's hydraulic press or by the common screw-press, in a room artificially heated. It is purified by rest, decantation, and filtration. It is bleached by exposure to light on the tops of houses.

In Calcutta, it is prepared as follows: The fruit is shelled by women; the seeds are crushed between rollers, then placed in hempen cloths, and pressed in the ordinary screw or hydraulic press. The oil thus procured is afterwards heated with water in a tin boiler until the water boils, by which the mucilage or albumen is separated as a scum. The oil is then strained through flannel and put into canisters. The castor seeds are distinguished according to the country yielding them. Two principal kinds are known, the large and the small nut; the latter yields the most oil.⁸ The best East Indian castor-oil is sold in London as cold drawn.

In the Southern provinces of India, according to Ainslie,⁹ castor-oil is obtained by decoction.

Much of the American castor-oil is prepared by mere expression, rest, and decantation; but the following are the outlines of the process usually employed in the United States by those who prepare it on the large scale. The seeds, cleansed from the dust and fragments of the capsules, are placed in a shallow iron reservoir, where they are submitted to a gentle heat insufficient to scorch or decompose them, and not greater than can be readily borne by the hand. The object of this step is to render the oil sufficiently liquid for easy expression. The seeds are then introduced into a powerful screw-press, and submitted to pressure, by which a whitish oily liquid is obtained, which is boiled with a considerable quantity of water in clean iron boilers, and the impurities skimmed off as they rise to the surface. The water dissolves the mucilage and starch, and the heat coagulates the albumen, which forms a whitish layer between the oil and water. The clear oil is now removed, and boiled with a minute portion of water until aqueous vapour ceases to arise, and till a small portion of the liquid taken out in a phial preserves a perfect transparency when it cools. The effect of this operation is to clarify the oil, and to render it less irritating by driving off the volatile acrid matter. But much care is requisite not to push the heat too far, lest the oil acquire a brownish hue, and an acrid peppery taste similar to the West India medicine. One basket of the seeds yields five or six quarts, or about twenty-five per cent., of the best oil.¹⁰

In the West Indies the oil is obtained by decoction; but none of it comes to this country in the way of commerce. In Jamaica, the bruised seeds are boiled with water in an iron pot, and the liquid kept constantly stirred. The oil, which separates, swims on the top, mixed with a white froth, and is skimmed off. The skimmings are heated in a small iron pot, and strained through a cloth. When cold, it is put in jars or bottles for use.¹¹ The object of the second heating is to dissipate the volatile acrid principle; but if the process be not suspended immediately after the water is driven off, the oil acquires a reddish-brown colour, an acrid flavour and irritating qualities. It is said that the seeds are sometimes roasted to increase the product. By this process also the oil is coloured and rendered acrid.

In Armenia, the oil is obtained by decoction; in Russia, by expression.¹²

On the continent of Europe, castor-oil is sometimes obtained by the agency of alcohol. The process is more expensive, and the product is inferior.

¹ Quoted by Nees and Ebermaier, *Handb. d. med.-pharm. Botan.*

² *Journ. de Pharm.* 3me ser. t. xiv. p. 189, 1848.

³ *Matr. Dr. Lehre von d. Giften.* i. 128.

⁴ *Nouveau Traité de Pharmacie.*

⁵ Private information from an oil-presser of Calcutta.

⁶ *United States Dispensatory.*

⁷ *Chemical Gazette*, vol. i. p. 210, 1843.

⁸ *Mat. Med.* t. ii. p. 823, ed. 2nda.

⁹ *Lond. Med. Gaz.* vol. xix. p. 944.

¹⁰ *United States Dispensatory.*

¹¹ *Materia Indica*, vol. i. p. 256.

¹² *Wright, Med. Plants of Jamaica*, in *Lond. Med. Journ.* vol. viii.

The *oleum ricini alcoholicum*, in use in Italy, is apparently an alcoholic extract, composed of 72 per cent. of oil and 28 per cent. of alcohol and water. The dose is from half an ounce to an ounce.¹

Properties.—Castor-oil is a viscid oil, usually of a pale yellow colour, with a slightly nauseous odour and a mild taste. It is lighter than water, its sp. gr. being, according to Saussure, 0.969 at 55° F. When cooled down to about 0°, it congeals into a transparent yellow mass. By exposure to the air it becomes rancid, thick, and ultimately congeals, without becoming opaque; and hence it is called a *drying oil*. When heated to a little more than 500° F. it begins to decompose.

Solubility.—Castor-oil is remarkable for its ready solubility in alcohol. Strictly speaking, castor-oil and alcohol exercise a mutual solvent action on each other. When they are shaken together, an homogeneous transparent mixture is obtained. Rectified spirit of wine² may be substituted frequently with a similar result; but with some samples of genuine oil the mixture does not become clear until heat is applied; and moreover by standing a separation takes place into two strata, an upper spirituous one holding oil in solution, and an inferior oleaginous one containing spirit. In one experiment, 65 vols. of oil and 65 vols. of rectified spirit were mixed, and by shaking a transparent uniform mixture was obtained: after several weeks a separation had taken place: the upper stratum measured 12 vols., the lower one 118 vols. Of three samples of genuine oil, one English, a second West Indian, and the third East Indian, I find the English to be the most, and the East Indian the least soluble in rectified spirit.—I find that castor-oil enables other fixed oils (olive, nut, lard, and other oils) to dissolve in alcohol. Thus, if one vol. of olive oil, 2 vols. of castor-oil, and 2 vols. of rectified spirit be mixed and heated, a transparent homogeneous solution is obtained.—Ether readily dissolves castor-oil.

Varieties.—In the London market there are chiefly three sorts of castor-oil; namely, the oil expressed in London from imported seeds, East Indian oil, and the American. West Indian and Australian oils are rarely to be met with.

1. *English Castor-Oil.*—By this is meant castor-oil drawn in England from imported seeds. It differs somewhat from the imported oil. I am informed that it never bleaches so completely by exposure to light as the East Indian oil. This is usually ascribed to the seeds having suffered some change before they are pressed. But something is probably due to the mode of preparation: in England the oil is not heated in boiling water, as it is in Calcutta.

2. *East Indian Castor-Oil* is the principal kind employed in this country. It is imported from Bombay and Calcutta. It is an oil of exceedingly good quality (both with respect to colour and taste), and is obtained at a very low price. It is procured from *Ricinus communis* and *R. lividus*. I am informed that occasionally it solidifies by keeping.

3. *American or United States Castor-Oil* is, for the most part, imported from New York. All the samples which I have examined have been of very fine quality, and, in my opinion, had a less unpleasant flavour than the East Indian variety. Our druggists object to it, on the ground of its depositing a white substance (*margaritine*) in cold weather—a circumstance which has led some persons to imagine it had been mixed with some other fixed oil (lard oleine?).

4. *West Indian Castor-Oil.*—For an authentic specimen of this oil I am indebted to Mr. Spencer, of Lamb's Conduit Street, who received it some years since from the wife of the Governor of the Island of Tobago, on whose estate it was procured. Its colour is that of golden brown sherry.

5. *Australian Castor-Oil.*—Of this I have seen but one sample, which was dark coloured.

Commerce.—Castor-oil is imported in casks, barrels, hogsheads, and dippers. The latter are made, as I am informed, of gelatin (prepared by boiling the cuttings of skin) moulded in earthen moulds. In this country the oil is purified by decantation and filtration, and is bleached by exposure to solar light on the tops of houses.

Composition.—The following is the *ultimate* composition of castor-oil, according to the analyses of Saussure and Ure:—

	Saussure.	Ure.
Carbon	74.178	74.00
Hydrogen	11.034	10.29
Oxygen	14.788	15.71
Castor-oil	100.000	100.00

¹ *Pharmaceutical Journal*, vol. vii. p. 354, 1848.

² According to Stoltze, benzoic acid augments the solubility of castor-oil in spirit containing 75 per cent. of alcohol; that is, in spirit whose sp. gr. is 0.860. Camphor has a similar influence.

The *proximate* principles have not been accurately determined. From Bussy and Lecanu's¹ researches we may infer that castor-oil contains three fats, each composed of oxide of glyceryle and a fatty acid. But according to the more recent investigations of Saalmuller,² there can be but two fats in this oil. In addition to these fats there is probably a small proportion of an acrid resin. The following table, therefore, represents the

PRESUMED COMPOSITION OF CASTOR-OIL.

Ricinoleine.
Margaritine.
Acrid resin?

1. *Ricinoleine*.—This has not been isolated. It is the constituent of castor-oil which by saponification yields oxide of glyceryle and a liquid acid, the *ricinoleic acid*, $C^{18}H^{35}O^5$. Bussy and Lecanu regard this acid as a mixture of two acids, which they term *ricinic* and *elaïodic* acids.

2. *Margaritine* ; or *Ricino-stearine*.—This is a solid, white crystalline fat which separates from castor-oil in cold weather. By saponification it yields oxide of glyceryle and a solid crystallizable fatty acid called *margaritic acid*, which in its melting point ($165^{\circ} F$) and composition exhibits a great resemblance to stearic acid, $C^{18}H^{36}O^2$. But with a margaritic acid obtained from another sample of castor-oil, he found the composition to approach more to that of palmitic acid, $C^{16}H^{32}O^2$.

According to Lecanu and Bussy, margaritic acid constitutes only 0.002 of the products of saponification of castor-oil: it follows, therefore, that the proportion of margaritine in the oil must be small. But it is probable that the quantity is variable, and that the differences observed in the action of alcohol in the different specimens of castor-oil depend on variations in the relative proportions of the margaritine and ricinoleine.

3. *Acrid Resin*?—Some years since, Soubeiran³ obtained from castor-oil by a complicated process what he supposed to be a soft resinous oil, but which was evidently a complex product. To this he in part ascribed the purgative qualities of castor-oil.

Products of decomposition.—By saponification and distillation castor-oil yields certain peculiar products by which it is characterized.

PRODUCTS OF SAPONIFICATION.

100 Parts of Castor-Oil yielded:

1. Fatty acids (viz. ricinic, elaïodic, and margaritic acids)	94
2. Glycerine	8

Total 102

PRODUCTS OF DISTILLATION.

(Average of Two Experiments:)

1. Distilled liquid	33.5
(a.) Water.	
(b.) Acetic acid.	
(c.) Acroleine (a small quantity).	
(d.) Cœnanthol.	[acids.]
(e.) Ricinic, elaïodic, and cœnanthyllic	
2. Solid residuum	63.0
3. Loss (inflammable gas)	3.5

Castor-oil 100.00

1. *Cœnanthol*.—Described by Bussy and Lecanu as *volatile oil*; but more recently by Bussy⁴ as *cœnanthol*. It is a colourless limpid aromatic liquid, whose formula is $C^{14}H^{14}O^2$. It is scarcely soluble in water, but dissolves in alcohol and ether. It rapidly oxidizes in the air, and becomes *cœnanthyllic acid* ($C^{13}H^{13}O^3$). It combines with water, forming a crystalline hydrate, $C^{14}H^{14}O^2.HO$. By the action of nitric acid it yields at a low temperature an isomeric compound called *metacœnanthol*; and at a high temperature, besides cœnanthyllic and other volatile fatty acids, a volatile oil resembling oil of cassia.

2. *Solid residuum of distillation*.—Pale, yellow, elastic, spongy, having the consistence of soft new bread, gelatiniform, odourless, tasteless, combustible, solid. It is insoluble in alcohol, ether, and the oils (both fixed and volatile).

By the action of hyponitric acid on castor-oil Boudet obtained a solid odorous fat called *palmine*, which, by saponification, yielded palmitic acid, $C^{16}H^{32}O^5.HO$, and glycerine; and by the action of nitric acid on castor-oil, Mr. Tilley⁵ obtained cœnanthyllic acid.

Adulteration.—Two kinds of frauds have been practised with regard to castor-oil.

One consists in the admixture of a small quantity of croton oil to it, with the view of increasing its activity. This mixture is introduced into gelatine capsules, and sold as *concentrated castor-oil*. This fraud is a very dangerous one. I have

¹ Journ. de Pharm. t. xiii. p. 57, 1827.² Annal. d. Chem. u. Pharm. Bd. lxxiv. S. 108, 1848; also The Chem. Gaz. vol. vi. p. 74, 1848.³ Journ. d. Pharm. t. xv. p. 507, 1829.⁴ Ibid. 3me ser. t. viii. p. 321, 1845; also, Chemical Gazette, vol. iii. p. 351, 1845.⁵ Memoirs of the Chemical Society, vol. i. p. 1, 1843.

heard of several cases in which very violent and dangerous effects were produced by these capsules on pregnant females.

The other fraud consists in the adulteration of the castor-oil with some bland viscid cheaper oil. I have been informed that the oleine of lard, called *lard oil*, has been used for this purpose, but I have not been enabled to procure evidence of it. This kind of fraud is said to be detected by alcohol, which dissolves the genuine castor-oil, but not the admixed oil; and accordingly, in the Edinburgh Pharmacopœia, the test of the purity of the oil is that "it is entirely dissolved by its own volume of alcohol." Unfortunately, however, for this test, castor-oil may be adulterated with 33 per cent. of another fixed oil, and yet be soluble in its own volume of alcohol.

PHYSIOLOGICAL EFFECTS.—*a. On Animals generally* castor-oil acts as a laxative or mild purgative. Large animals, as the horse, require a pint or more for a dose; smaller ones need only a few ounces.¹ Mr. Youatt, however, declares this oil to be both uncertain and dangerous in the horse.²

β. On Man.—*Injected into the veins* castor-oil gripes and purges, and causes a nauseous oily taste in the mouth:³ hence it would appear to have a specific influence over the mucous lining of the alimentary canal. *Swallowed* to the extent of one or two ounces, it usually acts as a mild but tolerably certain purgative or laxative, without producing any uneasiness in the bowels. "It has this particular advantage," says Dr. Cullen,⁴ "that it operates sooner after its exhibition than any other purgative I know of, as it commonly operates in two or three hours. It seldom gives any griping, and its operation is generally moderate—to one, two, or three stools only." It not unfrequently occasions nausea, or even vomiting, especially if somewhat rancid; in many cases, I believe, rather from its disgusting flavour than from any positively emetic qualities.

It has been stated by continental writers that castor-oil is most unequal in its action, at one time operating with considerable violence, at another with great mildness; but I have never found it so, nor is it usually considered to be so in this country. I can, however, readily believe that a difference in the mode of its preparation, especially with reference to the heat employed, may materially affect its purgative property.

When castor-oil has been taken by the mouth, it may be frequently recognized in the alvine evacuations; but it presents itself under various forms, "sometimes resembling caseous flakes, or a soap-like scum, floating on the more fluid part of the dejection: occasionally it had been arranged in a form not unlike bunches of grapes, or more nearly of hydatids of a white colour; more generally, however, it is found mixed up with the fæces as a kind of emulsion, and in some few instances it has been discharged under the form of solid tallow-like masses."⁵ Mr. Brande⁶ says in one case it was discharged from the bowels in the form of indurated nodules, which were at first regarded as biliary concretions. A remarkable case is mentioned by Dr. Ward, of a woman on whom this oil does not act as a purgative, but exudes from every part of her body.⁷

Uses.—Castor-oil is used to evacuate the contents of the bowels in all cases where we are particularly desirous of avoiding the production of abdominal irritation (especially of the bowels and the urino-genital organs). The principal, or I might say the only objection to its use in these cases, is its nauseous taste. The following are the leading cases in which we employ it:—

1. *In inflammatory affections of the alimentary canal*, as enteritis, peritonitis, and dysentery, a mild but certain purgative is oftentimes indicated. No substance, I believe, answers the indication better, and few so well, as castor-oil.

2. *In obstructions and spasmodic affections of the bowels*, as intussusception, ileus, and colic, especially lead colic, this oil is the most effectual evacuant we can employ.

¹ Moiroud, *Pharm. Vétér.* p. 280.

² *The Horse*, in *Library of Useful Knowledge*, pp. 212 and 387.

³ Dr. E. Hale, in *Begin's Traité de Thérapeutique*, p. 114.

⁴ Dr. Golding Bird, *Lond. Med. Gaz.* vol. xv. p. 225.

⁵ *Lond. Med. Gaz.* vol. x. p. 377.

⁶ *Mat. Med.*

⁷ *Dict. of Mat. Med.*

3. *After surgical operations about the pelvis or abdomen* (for example, lithotomy, and the operation for strangulated hernia), as well as after *parturition*, it is the best and safest purgative.

4. *In inflammatory or spasmodic diseases of the urino-genital organs*, inflammation of the kidneys or bladder, calculous affections, gonorrhœa, stricture, &c., castor-oil is a most valuable purgative.

5. *In affections of the rectum*, especially piles, prolapsus, and stricture, no better evacuant can be employed.

6. *As an anthelmintic* for tape-worms, castor-oil was first employed by Odier. Arneimann, however, has shown that it possesses no peculiar or specific vermifuge properties.

7. *As a purgative for children*, it has been used on account of its mildness, but its unpleasant taste is a strong objection to its use.

8. *In habitual costiveness*, also, it has been recommended. Dr. Cullen observed that, if castor-oil be frequently repeated, the dose might be gradually diminished; so that persons who, in the first instance, required half an ounce or more, afterwards needed only two drachms.

Administration.—The dose of castor-oil for children is one or two teaspoonfuls; for adults, from one to two or three tablespoonfuls. To cover its unpleasant flavour, some take it floating on spirit (especially gin), but which is frequently contra-indicated; others on coffee, or on peppermint or some other aromatic water; or it may be made into an emulsion by the aid of the yolk of egg or mucilage of tragacanth.

133. *Curcas Purgans*, Adanson; and *C. multifidus*, Endlicher.— Physic Nuts.

(Semina.)

The seeds of both these species of *Curcus* are met with under the name of *physic nuts*; and as their effects and uses are similar, I include them under a common head.

Gen. Char.—*Flowers* monœcious. *Calyx* very short, 5-parted. **MALES:** *Corolla* globose-campanulate, 5-cleft. *Stamens* 10, united at the base, the 5 exterior alternating with the same number of conoid glands; filaments filiform; anthers turned inwards, 2-celled. **FEMALES:** *Corolla* much larger than the calyx, convolute; consisting of 5 petals. *Ovary* on a 5-lobed disk, 3-celled, with 1 ovule in each cell. *Styles* 3, filiform, distinct. *Stigmas* thick, 2-lobed. *Capsule* 3-coccos, with 1 seed in each cell.—Tropical shrubs of America. *Leaves* alternate, petioled, angulate-5-lobed, quite entire, truncated at the base, reticulate-7-nerved, quite smooth. *Corymbs* with long peduncles; the males terminal; the females axillary (Endlicher).

Species.—1. *CURCAS PURGANS*, Adanson: *Jatropha Curcas*, Linn.; *English Physic Nut*, Wright; *Physic nut tree*, Hughes; Browne; *Angular-leaved Physic Nut*, Miller; *Pinheiro de purga*, *Pinhão paraguay*, Mart., Syst. Mat. Med. Brasil.—Leaves long-stalked, broadly cordate, angular, roundish; panicles terminal or axillary, in cymes.—West Indies; Brazils; Coast of Coromandel; Ceylon.

The fruit is a tricoccos capsule about the size and shape of a walnut.

The seeds (*semina curcadis*), sometimes called *American* or *English physic nuts*, or simply *physic nuts* (*nuces cathartice americanae*), *Barbados seeds* or *nuts* (*nuces barbadenses*), *semina ricini majoris* or *gras pignon d'Inde*, have the shape of castor seeds, but are somewhat rough to the touch, and black, but marked with numerous minute cracks. The kernels are covered with a fine white pellicle (*cuticula nuclei*). The seeds have been analyzed by Cadet de Gassicourt¹ and by Soubeiran.² The latter chemist found in them a fixed oil, a peculiar fixed acrid resin, saccharine matter, gum, a small quantity of fatty acid, glutine (emulsin?), a free acid (malic?), and some salts.

The expressed oil, commonly called *jatropha oil* (*oleum jatrophae curcadis* vel *oleum infernale*), was imported a few years ago under the name of *oil of wild castor seeds*. It is sometimes expressed in England. As commonly met with, it has a yellowish colour, with a feeble odour, and during the cold weather deposits a white solid fat (margarine or stearine). When fresh and pure it is described as being odourless, colourless, and quite limpid. 1000 parts of the seeds yielded Guibourt 656 parts of kernels, from which he obtained 265 parts of a colourless very fluid oil, which in the cold deposited a considerable quantity of stearine. *Jatropha* oil differs from castor and croton oils in its slight solubility in alcohol; but mixture with castor-oil

¹ Journ. de Pharm. t. x. p. 176, 1824.

² Ibid. t. xv. p. 503, 1829.

augments its solubility. According to Mr. Quekett,¹ it is well adapted for burning in lamps: for which purpose it is employed in India.

Jatropha seeds and oil resemble the seeds and oil of croton in the character of their effects. Mr. Bennett² swallowed four seeds, and experienced a very unpleasant sensation in the stomach and bowels, with nausea, which, after an interval of nearly two hours, terminated in vomiting: their purgative effects followed soon afterwards, and were mild; the sickness had then passed away, but the burning sensation continued for some time longer. The kernels of five seeds caused in a labourer vomiting, purging, perspiration, debility, giddiness, and delirium. Four hours after taking the poison he walked to the London Hospital: the pupils were natural, the countenance pale, the hands cold, and the pulse 140. An opiate and a mild cordial were given to him, and he soon recovered.³ Jatropha oil is occasionally used as a drastic purgative. It is less powerful than croton oil. Dr. Christison states that twelve or fifteen drops of it are about equal to one ounce of castor-oil. The residual cake from which the oil has been expressed is very active. The last-mentioned authority found that a few grains of it caused violent vomiting and purging. The juice of the plant⁴ has been successfully applied externally as a remedy for piles. Dr. McWilliam⁵ says, that a decoction of the leaves is used by the natives of the Cape Verde Islands to excite a secretion of milk in women who have borne a child, and who are not past child bearing.

2. *CURCAS MULTIFIDUS*, Endlicher, Euebir. Botan.; *Jatropha multifida*, Linn.; *Adenorhopium multifidum*, Pohl; *French Physic Nut*; *Spanish Physic Nut*.—Leaves large, stalked, palmate or digitate, many-lobed, smooth; lobes pinnatifid, cuneate.—West Indies; Brazils.—The capsule is yellowish, about the size of a walnut, obtusely 3-cornered, somewhat tapering above, 3 celled; each cell containing 1 seed. The seeds, called *French physic nuts* (*semina curcadis multifidi*; *nucis purgantes*; *avellana purgatrice*; *ben magnum*), are about the size of those of a common nut, rounded externally, with two flattened surfaces separated by an ovule internally. The seed coat is marbled and smooth: the kernel is white.—The composition of these seeds is, according to Soubeiran,⁶ similar to that of the seeds of the *Curcas purgans*.—The expressed oil (*oleum curcadis multifidi*; *oleum pinhoen*), as well as the seeds, are drastic cathartics. In their operation they resemble the preceding oil and seeds. Death is said to have been produced by them.⁷

3. The seeds of the *JATROPHA GOSSYPIFOLIA*, Linn.; *Bastard French Physic Nut*, *Belly-ache, or Wild Cassada*, have also been used as purgatives in dropsies.⁸

134. *Anda brasiliensis*, Raddi.

(Semina.)

Anda, Piso, I. 72; II. 148; *Anda brasiliensis*, Raddi, Quarante piante, &c. 1821; *Anda Gomesii*, Ad. Jussieu, De Euphorb. Generib. 1824; *Anda-agu*, Indayagu, *Purga de Gentio*; *Coco de Purga*, *Purga dos Paulistas*, *Frutta d'Arara*, Brazil.—Brazil.—The fruit is about the size of an orange, with 2 large and 2 smaller angles. It contains two roundish nut-like seeds (*semina anda brasiliensis*) about the size of small chestnuts. By pressure they yield a fixed oil (*oleum anda brasiliensis*; *oil of anda-agu*). Both seeds and oil are purgative. One seed, according to Von Martius,⁹ is a dose for a man. The expressed oil is clear and pale yellowish. Like jatropha oil, it is not very soluble in alcohol; but its solubility is increased by the addition of castor-oil. Mr. Ure¹⁰ found that in doses of 20 drops it operated moderately as a purgative.

135. *MANIHOT UTILISSIMA*, Pohl,¹¹—BITTER CASSAVA.

Sex. Syst. Monœcia, Monadelphia.

(Fecula of the root; Tapioca, E. D. [U. S.])

SYNONYMES.—*Jatropha Manihot*, Linn.; *Janipha Manihot*, HBK. ii. 85; Hooker, Bot. Mag. t. 3071.

HISTORY.—Monardes¹² describes the Indian method of making cassava bread; and Piso¹³ notices the mode of preparing the farina called cream of *Tapioca* [*Tapioca*].

BOTANY. Gen. Char.—*Flores* monœcious. *Calyx* corolline, campanulate, 5-cleft, convolute. *Corolla* 0. *Stamens* 10, inserted on the margin of a fleshy

¹ Practical Treatise on the Use of the Microscope. p. 138, 1818.

² Lond. Med. Gaz. vol. ix. p. 9.

³ Letheby, Lond. Med. Gaz. N. S. vol. vii. p. 116, 1848.

⁴ Lunan, Hort. Jamaicensis, vol. ii. p. 62, quoted by Dr. Hamilton in the Pharmaceutical Journal, vol. v. p. 26, 1845.

⁵ Report on the Boa Vista Fever, 1847.

⁶ Journ. de Pharm. t. xv. p. 506, 1829.

⁷ Sloane's Jamaica, vol. i. p. 36.

⁸ Hamilton, Pharmaceutical Journal, vol. v. p. 27, 1845.

⁹ Systema Mat. Med. Veget. Brasil.

¹⁰ Pharmaceutical Journal, vol. ix. p. 9, 1849.

¹¹ Plant. Brasil. Icones et Descript., fol. Vindob. 1827-31.

¹² Clusii Exoticor. lib. x. cap. p. 53, 330.

¹³ De Medicina Erasii. p. 52.

disk, free, the alternate ones shorter: *filaments* filiform; *anthers* turned inwards, 2-celled. *Ovary* placed on the fleshy disk, 3-celled, with 1 ovule in each cell. *Style* short. *Stigmas* 3, many-lobed, the lobes consolidated into a conical sinuated-sulcated mass. *Capsule* 3-coccous; the cocci 2-valved and 1-seeded (Endlicher).

Sp. Char.—*Leaves* with very long petioles, deeply 7-parted, palmate; the segments lanceolate, acuminate, attenuated at the base, quite entire, the outer ones smaller, unequal, diverging, straggling. *Root* whitish-yellow (Pohl).

Root large, thick, tuberous, fleshy; containing an acrid, milky, highly poisonous juice. *Flowers* axillary, racemose.¹

Hab.—Native of the Brazils; where, as well as in other parts of South America, it is cultivated.

MANIHOT AIPÍ, Pohl.—*Sweet Cassava*, Bancroft, Nat. Hist. of Guiana, 1769.—This is usually regarded as a variety of the above; but Pohl considers it to be a distinct species; characterized by the leaves which are 5-parted, and by the root, which is reddish, and contains a milky non-poisonous juice. It is cultivated in the Brazils, and in Spanish America.

MANIHOT JANIPHA, Pohl; Jatropha Janipha, Linn.; Janipha Loefflingii, HBK.—This species is said to yield the *sweet* or *white cassava* of the West Indies. Dr. Hamilton² says it so closely resembles the *Janipha Manihot*, Linn. (*Manihot utilissima*, Pohl), that an experienced eye can hardly distinguish it with certainty. Is not the sweet cassava of the West Indies the *Manihot Aipi* of Pohl? Like the latter, it is devoid of poisonous properties.

DESCRIPTION.—1. *Bitter cassava root* is a large tuberous root³ which abounds in a poisonous milky juice. It is difficult to distinguish by its appearance from the sweet cassava root; but it is devoid of the tough, fibrous, or woody filaments found in the heart of the sweet cassava root; and it does not become soft, like the latter root, by boiling or roasting. The rasped root mixed with water, boiled, and then fermented, yields a spirituous liquor called *cassiri*.⁴ *Cassava meal* is obtained by subjecting the grated root to pressure to express the juice, and then drying and pounding the residual cake. Of this meal *cassava bread* is made. The expressed juice by repose deposits the farina called *cassava starch*, of which *tapioca* is made. A sauce called *casareep* or *cassirepe*, is made from the juice.⁵

2. *Sweet cassava root* resembles the bitter cassava root in external appearance; but, unlike the latter, it is not poisonous. It has a bundle of tough, fibrous, or woody filaments at the heart, running longitudinally through the root. By boiling or roasting it becomes soft, and is used at table.

A few pounds of *dried sweet cassava root* have recently been sent to England from Jamaica on speculation, to ascertain whether it was likely to prove a profitable article of commerce. It consisted of transverse and longitudinal segments, which were beautifully white, had a very faint agreeable odour, and were mucilaginous or farinaceous to the taste. The circular disks were from one to two or more inches in diameter, and had in the centre the ligneous cord above alluded to. Some of the pieces were worm-eaten: a few were slightly scorched or burnt, apparently by over-heating in the drying process.

Cassava meal and *bread*, *cassava starch*, and *tapioca*, are prepared from the sweet as well as from the bitter cassava root.

COMPOSITION.—The bitter cassava root has been analyzed by MM. O. Henry and Boutron-Chalard,⁶ who inferred that it contained *free hydrocyanic acid*, *starch*, a small quantity of *sugar*, an *organic salt of magnesia*, a *bitter principle*, a *crystallizable fatty matter*, an *azotized matter* (vegetable osmazome), *phosphate of lime*, and *woody fibre*.

¹ Hooker, Bot. Mag. t. 3071.

² Hamilton, Pharmaceutical Journal, vol. v. p. 27, 1845.

³ A figure of the root is given in the Journ. de Pharm. t. xxii. 1836.

⁴ Dr. Hamilton, Pharmaceutical Journal, vol. v. p. 29, 1849.

⁵ *Casareep* is the concentrated juice of the roots of the bitter cassava flavoured by aromatics. During the evaporation, the poisonous principle of the juice is either dissipated or destroyed. *Casareep* is used to flavour soups and other dishes; and is the basis of the West Indian dish *pepper-pot*. It is a powerful antiseptic (Shier, Report on the Starch-producing Plants of the Colony of British Guiana, Demerara, 1847; Hamilton, Pharmaceutical Journal, vol. v. p. 30, 1845).—In French Guiana, the term *cabiou* or *cabion* is applied to a similar condiment (Henry and Boutron-Chalard, Journ. de Pharm. t. xxii. p. 123). The unspiced juice flavoured with capsicum pods is used in the Brazils as a sauce, under the name of *Tucup*, or *Tucupi* (Martius, Syst. Mat. Med. Veg. Brasil, p. 94).

⁶ Journ. de Pharm. t. xxii. p. 118, 1836.

1. **HYDROCYANIC ACID.**—According to O. Henry and Boutron-Chalard, the active principle of the root is hydrocyanic acid. Their statement is confirmed by Dr. Christison, who examined some well-preserved juice from Demerara.

2. **VOLATILE ACRID PRINCIPLE?**—The vomiting and purging, and other abdominal symptoms ascribed to bitter cassava, would lead us to suspect that, like other euphorbiaceous plants, it contains an acrid principle.

PHYSIOLOGICAL EFFECTS.—The fresh roots as well as the expressed juice are virulent poisons, destroying life in a very short period of time. O. Henry and Boutron-Chalard described the effects on guinea-pigs as resembling those caused by hydrocyanic acid; but death did not occur until from forty to fifty-five minutes after the use of the poison. Ricord Madianna¹ has killed dogs in ten minutes with a poison obtained from this root. The symptoms described by Barham² are pain and swelling of the abdomen, vomiting and purging, dimness of sight, syncope, rapid diminution of the powers of life, and death in a few hours. Half a pint of the juice has produced death in an hour.³

USES.—Dr. Wright⁴ says that the scrapings of the fresh root are successfully applied to ill-disposed ulcers; and Dr. Hamilton⁵ speaks of the instantaneous relief which he experienced on himself from the application of a cataplasm of the rasped roots, with all their juices unexpressed, to the spot where a nest of chigres (*Pulex penetrans*) had been dislodged. The root is used to catch birds, which, by eating it, lose the power of flying.⁶ It yields cassava meal and cassava starch.

1. **FARINA MANDIOCÆ; Cassava or Cassada Meal; Farinha de Pao**, or simply *Farinha*; *Farine de Manioc*.—This is obtained by washing and scraping the roots, then rasping or grating them, and subjecting the pulp to pressure, by which the poisonous juice is expressed. The residual compressed pulp is then dried over a fire, being stirred during the whole time. In this way is obtained *cassava meal*.⁷

Cassava meal is a mixture of *cassava starch*, *vegetable fibre*, and *proteine* or *albuminous matters*. Dr. Shier⁸ found that in the sliced and dry roots the percentage of nitrogen is 0.78, but in the cassava meal (the juice expressed) only 0.36. If these numbers be multiplied by 6.5 (see foot-note at p. 106), the percentage quantity of protein or albuminous matters in the dried root will be 5.0, and in cassava meal 2.34.

I have received from Dr. Shier two kinds of cassava meal; one called cassava meal, the other termed cassava flour. I shall distinguish them as coarse and fine meal.

a. **Coarse Cassava Meal; Cassava Meal**, Shier; *Couaque* or *Couac*, Guibourt. —This is meal which in coarseness is about equal to sawdust or small dried crumbs of bread. I have found a similar preparation in English commerce under the name of "*Tapioca Flour from Bahia*."

Coarse cassava meal has a slight yellowish or brownish tint, varying in different samples.

β. **Fine Cassava Meal; Cassava Flour**, Shier; *Farine de Manioc*, Guibourt. —This is a finer and whiter meal than the preceding. In fineness it resembles wheat flour.

Cassava bread or *cassava cakes* are made by baking the compressed cassava pulp on a hot plate, in the manner muffins and crumpets are baked in England.

Cassava meal and cassava bread are important and valuable articles of food to the inhabitants of tropical America. The flavour of cassava cakes reminds me of Scotch oatcakes.

2. **AMYLUM MANDIOCÆ; Mandioca or Cassava Starch; Tapioca**.—The juice which is expressed from the rasped root deposits on standing an amylum or starch (*cassava starch*), of which *tapioca* is made.

¹ Quoted by Sloane, *Jamaica*, vol. ii. p. 363.

² *Journ. de Pharm.* t. xvi. p. 310, 1830.

³ Martius, in Wibmer, *Arzneim. u. Gifte*, Bd. iii. S. 273.

⁴ *Hortus Americanus*, p. 34, 1794.

⁵ *Med. Plants of Jamaica*.

⁶ *Pharmaceutical Journal*, vol. v. p. 28, 1848.

⁷ The details of the process for making cassava meal vary somewhat in different localities. According to Piso (*De Medicina Brasil.* lib. iv. p. 53), the roots are grated by a handmill somewhat similar to that used in the preparation of Tous-les-Mois (see ante, p. 222, Fig. 224). Edwards (*Voyage up the River Amazon*, p. 24, Lond. 1847) says they are grated upon stones, and the pulp compressed in a slender bag of rattan six feet in length.

⁸ *Report*, p. 15.

a. Cassava Starch; Tapioca Meal; Brazilian Arrow-root; Moussache or Cipipa.—The fecula or starch deposited from the expressed juice of the cassava root, after being washed and dried in the air without heat, constitutes the *tapioca meal* or *Brazilian arrow-root* of commerce. It is usually imported into this country from Rio Janeiro. For some years past it has been imported into France from Martinique, and is sold as arrow-root (Guibourt). It is white and pulverulent, and resembles in external appearance genuine arrow-root (maranta starch). When examined by the microscope, however, it is readily distinguished.

Cassava starch, when examined by the microscope, is found to consist of small single grains,¹ which, in the living plant, were united in groups or compound grains, each composed of 2, 3, or 4 grains. Most of the grains are mullar-shaped, and, therefore, have been united in groups of two each: when seen endwise, they appear circular or globular. Some of them are truncated egg-shaped grains, with one or two facets at the truncation. The nucleus, central cavity, or hilum, is circular, surrounded with rings, and bursts in a stellate manner.

These statements apply equally to *bitter cassava starch* and *sweet cassava starch* sent to me from Demerara by Dr. Shier, as well as to starch obtained by myself from sweet cassava root received from Jamaica.

Cassava starch has not been analyzed; but there can be no doubt but that its composition is similar to that of other starches, and that its formula is $C^{12}H^{10}O^{10}$. Its effects and uses are also like those of other starches (see *ante*, p. 119).

β. Tapioca.—This is imported from Bahia and Rio Janeiro. It is cassava meal, which while moist or damp has been heated, for the purpose of drying it, on hot plates. By this treatment the starch grains swell, many of them burst, and the whole agglomerate in small irregular masses or lumps. In consequence of the change thus effected in the starch grains, tapioca is partially soluble in cold water; and the filtered cold infusion strikes a blue colour with tincture of iodine. The drying to which it has been subjected renders it difficult of solution. In boiling water it swells up, and forms a transparent viscous jelly-like mass. Submitted to prolonged ebullition in a large quantity of water, it leaves an insoluble residue, which precipitates. This, when diluted with water and coloured by iodine, appears to consist of mucous flocks.

Made into puddings, tapioca is employed as a dietetical substance. Boiled in water or milk, and flavoured with sugar, spices, or wine, according to circumstances, it is used as an agreeable, nutritious, light, easily digestible article of food for the sick and convalescent. It is devoid of all irritating and stimulating properties.

136. *Crozophora tinctoria*, Necker.—Turnsole.

(Succus.)²

Heliotropium tricoecum, Pliny, lib. xxii. cap. 29; *Croton tinctorium*, Linn.—South of France: Mediterranean coast. Cultivated since 1833 in the neighbourhood of Grand Gallargus, in the department of Gard, in France. The expressed juice is green: but, under the combined influence of the air and ammonia, it becomes purplish. Coarse sacking stained purple by this juice is termed *turnsole rags* (*ournesol en drapeaux*), or *bezetta*² *carulea*. These rags are exclusively employed by the Dutch; but for what purpose is not well known, though it has been supposed for colouring cheese, confectionery, liqueurs, &c.³

¹ The following are the measurements, in parts of an English inch, of ten grains of cassava starch. They were made by Mr. George Jackson:—

Lengths. Breadths.		Lengths. Breadths.	
1	0.0012 × 0.0012	6	0.0005 × 0.0004
2	0.0008 × 0.0008	7	0.0004 × 0.0004
3	0.0008 × 0.0007	8	0.0003 × 0.0003
4	0.0007 × 0.0006	9	0.00025 × 0.0002.5
5	0.0005 × 0.0004	10	0.0002 × 0.0002

² *Bezetta*, the diminutive of the Spanish word *bezo*, a lip, a term originally applied to pigments used to color the lips.

³ See an interesting notice of Turnsole by Mr. D. Hanbury, jun. in the *Pharmaceutical Journal*, vol. ix. p. 308, 1850.

ORDER XXXIV. ARISTOLOCHIACEÆ, *Lindley*.— BIRTHWORTS.

ARISTOLOCHIEÆ, *Jussieu*; ASARINÆ, *Bartling*.

CHARACTERS.—*Flowers* hermaphrodite, axillary, solitary. *Calyx* adherent (superior), tubular, monosepalous, with the segments valvate or induplicate in æstivation, sometimes regular, sometimes very unequal. *Stamens* 6 to 12, epigynous, distinct, or adhering to the style and stigmas. *Ovary* inferior, 6-celled, very rarely 3—4-celled; *ovules* numerous, anatropal, horizontally attached to the axis. *Style* simple. *Stigmas* radiating, as numerous as the cells of the ovary. *Fruit* dry or succulent, 3—4—6-celled, many-seeded. *Seeds* thin, with a very minute embryo placed at the base of fleshy albumen—*Herbs* or *shrubs*, the latter often climbing. *Wood* without concentric zones and inseparable wedges. *Leaves* alternate, simple, stalked.

PROPERTIES.—Not important. The roots possess stimulant properties, owing to the presence of volatile oil. Some of them are acrids. Bitter extractive renders them somewhat tonic.

137. ARISTOLOCHIA SERPENTARIA, *Linn.*—THE VIRGINIAN SNAKE-ROOT.

Aristolochia officinalis, *Nees* and *Ebermaier*.

Sex. Syst. Gynandria, Hexandria.

(*Radix*, *L.*—The root, *E. D.*)

HISTORY.—The first writer who distinctly mentions *Virginian snake-root*, or *snake-weed*, is Thomas Johnson, an apothecary of London, in his edition of *Gerarde's Herbal*, published in 1633.

BOTANY. *Gen. Char.*—*Calyx* tubular, ventricose at the base, dilated at the apex, and extended into a ligula. *Anthers* 6, subsessile, inserted on the style. *Stigma* 6-lobed. *Capsule* 6-angled, 6-celled (*Bot. Gall.*).

Sp. Char.—*Stem* flexuous, ascending. *Leaves* cordate, acuminate, on both sides pubescent. *Peduncles* nearly radical, unifloral. Lip of the *calyx* lanceolate (*Nees* v. *Esenbeck*).

Hab.—North America.

COLLECTION AND PROPERTIES.—The root (*radix serpentariæ*) is collected in Western Pennsylvania and Virginia, in Ohio, Indiana, and Kentucky.¹ It is imported in bales, usually containing about 100 lbs. As met with in the shops, it consists of a tuft of long, slender, yellowish or brownish fibres, attached to a long, contorted head or caudex. The odour is aromatic, the taste warm and bitter.

COMPOSITION.—It was analyzed by Bucholz in 1807;² by Chevallier in 1820;³ and by Peschier in 1823.⁴

Bucholz's Analysis.

Volatile oil	0.50
Greenish-yellow soft resin . . .	2.85
Extractive matter	1.70
Gummy extractive	18.10
Lignin	62.40
Water	14.45

Serpentary root 100.00

Chevallier's Analysis.

Volatile oil.
Resin.
Extractive.
Starch.
Ligneous fibre.
Albumen.
Malate and phosphate of lime.
Oxide of iron and silica.

Serpentary root.

1. **VOLATILE OIL.**—Grassmann⁵ obtained only half an ounce from 100 lbs. of the root. Its colour is yellowish, its odour considerable, its taste not very strong.⁶ Grassmann compares the odour and taste to those of valerian and camphor combined.

2. **BITTER PRINCIPLE;** *Extractive*, Bucholz and Chevallier.—This is very bitter and slightly acrid. It is soluble in both water and spirit. Its solution, which is yellow, is rendered brown by alkalis, but is unchanged by the ferruginous salts.

¹ *United States Dispensatory.*

² *Journ. de Pharm.* vi. 365.

³ Quoted by Dr. W. C. Martius, *Pharmacogn.*

⁴ *Gmelin, Hand. d. Chem.*

⁵ *Gmelin, op. cit.*

⁶ *Lewis, Mat. Med.*

PHYSIOLOGICAL EFFECTS.—These have been examined by Jörg and his pupils.¹

In *small doses*, serpentary promotes the appetite. In *large doses*, it causes nausea, flatulence, uneasy sensation at the stomach, and more frequent but not liquid stools. After its absorption, it increases the frequency and fulness of the pulse, augments the heat of the skin, and promotes secretion and exhalation. Furthermore, it would appear, from the experiments before referred to, that it causes disturbance of the cerebral functions, and produces headache, sense of oppression within the skull, and disturbed sleep.

In these properties, serpentary bears some analogy to, but is much weaker than, camphor. It is more powerful than contrayerva.

USES.—Its employment is indicated in cases of torpor and atony. It was formerly termed *alecipharmic*, on account of its fancied power of curing the bite of a rattlesnake and of a mad dog.² At the present time it is rarely employed. It has been much esteemed as a stimulant in *fevers*, both continued and intermittent. A scruple of serpentary, taken in three ounces of wine, is mentioned by Sydenham³ as a cheap remedy for tertians in poor people. Dr. Cullen⁴ considered it as suited for the low and advanced stage of typhus only. In an epidemical affection of the throat (called the *throat-distemper*), it was given internally as a diaphoretic, and used with sumach berries, in the form of a decoction, as a gargle, with benefit.⁵

ADMINISTRATION.—The dose of it in substance is from ten to thirty grains. The infusion is the best form for the administration of serpentary.

1. INFUSUM SERPENTARIÆ, L. E. [U. S.]; *Infusion of Serpentary, or Snake-root.*—(Serpentary ʒss; Boiling Water Oj. Infuse for four hours in a covered vessel, and strain [through linen or calico, *E.*].)—Dose, fʒj or fʒij every two or three hours, according to circumstances.

2. TINCTURA SERPENTARIÆ, L. E. [U. S.]; *Tincture of Serpentary, or Snake-root.*—(Serpentary, bruised [in moderately fine powder, *E.*], ʒijss, *L.*; Proof Spirit Oij; and Cochineal, bruised, ʒj, *E.* Macerate for seven days, and filter. "Proceed by percolation or digestion as for the tincture of cinchona," *E.*—[Take of Virginia Snake-root, bruised, ʒij; Diluted Alcohol Oij. Macerate for fourteen days, express, and filter through paper, *U. S.*].—Used as an adjunct to tonic infusions. Dose, from fʒj to fʒij.

138. ASARUM EUROPÆUM, Linn.—COMMON ASARABACCA.

Sex. Syst. Dodecandria, Monogynia.

(Folia, *L. D.*)

HISTORY.—This plant was used in medicine by the ancients. Dioscorides⁶ calls it *άσάρον*.

BOTANY. Gen. Char.—*Calyx* campanulate, 3-lobed. *Stamens* 12, inserted on the ovary; *anthers* adnate to the middle of the filaments. *Style* short. *Stigma* stellate, 6-lobed. *Capsule* 6-celled. (*Bot. Gall.*)

Sp. Char.—*Leaves* 2 on each stem, kidney-shaped, obtuse [somewhat hairy] (Smith).⁷

The branching *root-fibres* arise from an underground stem or *rhizome*. The aerial *stems* are several from each rhizome. *Leaves* petiolated. From the axil of the two leaves springs a solitary, rather large, drooping *flower*, upon a short peduncle, of a greenish-brown colour and coriaceous substance. Segment of the *calyx* incurved. *Capsule* coriaceous. *Seeds* ovate, with horny albumen.

Hab.—Indigenous. Perennial. Flowers in May.

DESCRIPTION.—The whole plant (root-fibres, rhizome, and aerial stems, with

¹ Wilmner, *Arzneyk. u. Gifte*, Bd. i. S. 221; also, *Journ. de Chim. Méd.* t. vii. p. 493.

² Dale, *Pharmacologia*.

³ *Med. Al.*

⁴ Lib. i. cap. ix.

⁵ *Works*, translated by Dr. Pechey, 1th edit. p. 233.

⁶ *Med. Obs. and Inquir.* vol. i. p. 211.

⁷ *Eng. Flora*.

leaves and flowers) is kept in the shops under the name of *asarabacca* (*radix cum herbâ asari*), but the leaves only are directed to be used in the Pharmacopœia. Dr. Batty¹ states that the plant is gathered for medicinal uses in the woods near Kirkby Lonsdale, Westmoreland. The *rhizome* is about as thick as a goose-quill, grayish, quadrangular, knotted. It has a pepper-like odour, and an acrid taste. The leaves are almost inodorous, but have an acrid, aromatic, and bitter taste.

COMPOSITION.—Goerz² published an analysis of the root in 1784; Lassaigne and Feneulle another in 1820;³ Regimbeau a third in 1827;⁴ and Gräger a fourth in 1830.⁵

Gräger's Analyses.

Root.		Herb.	
Volatile oil		Asarin	0.10
Asarum-camphor }	0.630	Tannin	0.04
Asarin [? Asarite] }		Extractive	5.49
Asarin	1.172	Chlorophylle	1.52
Tannin	1.072	Albumen	2.42
Extractive	3.972	Citric acid	0.51
Resin	0.156	Ligneous fibre	15.00
Starch	2.018	Water	71.81
Glutin and albumen	1.010	Loss	0.35
Citric acid	0.316		
Ligneous fibre	12.800		
Salts (citrates, chloride, sulphate, and phosphates)	3.042		
Water	74.600		
Fresh root of asarabacca	100.818	Fresh herb of asarabacca	100.00

1. VOLATILE OILY MATTERS.—By submitting asarabacca root to distillation with water, three volatile oily matters are obtained; one liquid and two solid, at ordinary temperatures.

a. *Liquid Volatile Oil (Oleum Asari)*.—It is yellow, glutinous, lighter than water, and has an acrid, burning taste, and a penetrating valerian-like odour. It is slightly soluble in water, more so in alcohol, ether, and the oils (volatile and fixed). Its constituents are $C^{12}H^{10}O$.

β. *Asarite* of Gräger.—In small needles of a silky lustre. It is odourless and tasteless. It is fusible and volatilizable by heat; its vapour being white and very irritating. It is soluble in alcohol, ether, and the volatile oils, but not in water. Both nitric and sulphuric acids dissolve the crystals without the evolution of gas: if water be added to the sulphuric solution, the asarite is thrown down unchanged.

γ. *Asarum-camphor*.—Is distinguished from asarite by the following characters: Water throws it down from its alcoholic solution in cubes or six-sided prisms, whereas asarite is precipitated in delicate flexible needles. It dissolves in nitric acid without effervescence. Water added to its sulphuric solution throws down a brown resin. After fusion, it has the form of a crystalline, striated mass. Its composition is $C^{12}H^{10}O^2$. Blanchet and Sell regard it as the hydrate of the liquid volatile oil.

2. BITTER PRINCIPLE OF ASARABACCA (*Asarin* of Gräger and of some other pharmacologists).—Brownish, very bitter, soluble in alcohol.

PHYSIOLOGICAL EFFECTS.—Every part of the plant possesses acrid properties. Applied to the mucous membrane of the nose, it excites sneezing, increased secretion of mucus, and even a discharge of blood. Swallowed, it causes vomiting, purging, and griping pains. It is also said to possess diuretic and diaphoretic properties. Dr. Cullen has enumerated it in his list of diuretics, but expresses his doubts whether it possesses any specific power of stimulating the renal vessels.

USES.—Asarabacca has been employed in medicine to excite vomiting, and as an emetic. As an emetic, it is now superseded by ipecacuanha and tartarized antimony. As an errhine, to excite irritation and a discharge of mucus from the nasal membrane, it has been used in certain affections of the brain, eyes, face, mouth, and throat, on the principle of counter-irritation: thus in paralytic affections of the mouth and tongue, in toothache, and in ophthalmia.

ADMINISTRATION.—We may administer either the root or leaves, recollecting that the latter are somewhat milder than the former. As an *emetic*, the dose is half a drachm to a drachm. As an *errhine*, one or two grains of the root, or three

¹ Eng. Flora.

² Journ. de Pharm. t. vi. p. 561.

³ Goebel and Kunze, Pharm. Waarenz.

⁴ Pfaff, Mat. Med. Bd. iii. S. 229.

⁵ Ibid. t. xiv. p. 299.

or four grains of the dried leaves, are snuffed up the nostrils every night.—The powder of this plant is supposed to form the basis of *cephalic snuff*.

PULVIS ASARI COMPOSITUS; *Compound Powder of Asarabacca*.—(Asarabacca Leaves, dried, ʒj; Lavender Flowers, dried, ʒj. Reduce them together to powder.)—Used as an errhine in headache and ophthalmia. Dose, from grs. v to grs. viii.

139. *Aristolochia rotunda*, Linn.; et *A. longa*, Linn.—Round and Long Birthwort.

Sez. Syst. Gynandria, Hexandria.

(Radix.)

Both of these plants are natives of the South of Europe. Their roots are still kept in the shops. The long aristolochia root is several inches in length, one or two inches broad, and has a more or less cylindrical form. The round aristolochia root has a more rounded and knobby form. Both kinds are bitter and acrid, and have, especially when powdered, a disagreeable odour. They contain extractive matter and starch. Lassaigne found ulmin in the long species. Their effects are stimulant and tonic. Their stimulant effects are supposed by some to be principally directed to the abdominal and pelvic viscera. They have been employed in amenorrhœa as an emmenagogue. Their dose is from ʒj to ʒj. Round aristolochia root is a constituent of the *Duke of Portland's powder for the gout*, which consisted of equal quantities of the roots of *Gentian* and Birthwort (*Aristolochia rotunda*), the tops and leaves of *Germander* (*Chamaedrys*), Ground Pine (*Chamaepitys*), and lesser Centaury (*Chironia Centaurium*), powdered and mixed together.¹

ORDER XXXV. LAURACEÆ, Lindley.—LAURELS.

LAURI, Jussieu.—*LAURINEÆ*, Vent. and Rob. Brown.

CHARACTERS.—*Calyx* 4- to 6-cleft, with imbricated aestivation, the limb sometimes obsolete. *Petals* 0. *Stamens* definite, perigynous opposite the segments of the calyx, and usually twice as numerous; the 3 innermost, which are opposite the 3 inner segments of the calyx, sterile or deficient; the 6 outermost scarcely ever abortive; *anthers* adnate, 2- to 4 celled; the cells bursting by a longitudinal persistent valve from the base to the apex; the outer anthers valved inwards, the inner valved outwards [or both valved inwards, Lindl.] *Glands* usually present at the base of the inner filaments. *Ovary* single, superior, 1-celled [formed of 3 valvate carpellary leaves, and as many rib-like placentæ stationed at the sutures, all generally imperfect except one, Endl.], with 1 or 2 single pendulous ovules; *style* simple; *stigma* obtuse, 2- or 3 lobed. *Fruit* baccate or drupaceous, naked or covered. *Seed* without albumen; *embryo* inverted; *cotyledons* large, plano-convex, peltate near the base! *radicle* very short, included, superior; *plumule* conspicuous, 2-leaved.—*Trees*, often of great size. *Leaves* without stipules, alternate, seldom opposite, entire, or very nearly lobed. *Inflorescence* paniced or umbelled (Rob. Brown).

PROPERTIES.—The plants of this order owe their most important qualities to the presence of volatile oil, which is found, more or less abundantly, in all parts of the vegetable. This oil is sometimes liquid and highly aromatic, as oil of cinnamon; at others, it is solid in ordinary temperatures, and is endowed with narcotic properties, as camphor. The acrid principle of some species is probably a volatile oil.

In the bark and leaves, the volatile oil is usually associated with tannic acid, which gives them astringency, as in cinnamon. In the fruit and seeds, on the other hand, it is usually combined or mixed with fixed oil, as in bay-berries.

Besides the officinal lauraceous barks, presently to be described, there are several others which have obtained considerable celebrity, in the countries producing them, on account of their aromatic qualities.

Two of these bear the name of *clove bark*, on account of their odour. The *Indian clove bark* or *cortex cullilæan* is a large flat bark, and is obtained from *Cinnamomum Cullilæan*, Blume, a native of the Indian islands. Its properties are analogous to those of *Cassia-lignea*.² It is rarely met with in London. I have received from Dr. Martiny, of Hesse Darmstadt, a bark marked *Cullilæan papuanus*. It is, I presume, the produce of *Cinnamomum xanthoneuron* of Blume.

¹ See Dr. Clephane's *Inquiry into the Origin of the Gout Powder*, in the *Med. Observ. and Inq.* vol. i. Lond. Dr. Clephane concludes that "Celsus Aurelianus's *diacentaureon* and Aetius's *antidotus ex draculis centaurea generibus* were the same medicine, and are the old names for the Duke of Portland's Powder."

² See Pereira, in Lindley's *Flora Medica*, p. 331.

The *Brazilian clove bark*, or *clove cassia bark*, *cortex cassiæ caryophyllatæ*, is the produce of *Dicypellium caryophyllatum*, and grows in Para and Rio Negro. Its bark occurs in tubular quills.

Mussoy bark (in commerce *Misoï*) is the *cortex olinus* of Rumphius. It is used in the cosmetics of the natives of India.¹ I have never found it in the London shops.

Sintoc bark is the produce of *Cinnamomum Sintoc*, Blume. Its properties are analogous to those of *Culilawan*.

The *folia malabathri* of India are obtained from *Cinnamomum nitidum*, Hooker and Blume, and from *C. Tamala*. They are aromatic tonics, but are not found in the London market.

140. CINNAMOMUM ZEYLANICUM, Nees.—THE CEYLON CINNAMON.

Laurus Cinnamomum, Linn.

Sex. Syst. Enneandria, Monogynia.

(Cortex; et Oleum e cortice destillatum, L.—Bark; and volatile oil of the bark, E.—The bark, D.)

HISTORY.—Cinnamon (*Kinman*, Hebr.) is mentioned in the Old Testament,² about 1490 years before Christ. In all probability the Hebrews received it from the Arabians, who must, therefore, have had commercial dealings with India at this early period.³ The first notice of cinnamon (κιννάμωμον) by the Greek writers occurs in Herodotus,⁴ who died 413 years before Christ. Probably both the Hebrew and Greek names for this bark are derived from the Cingalese *cayn-nama* (*dulce lignum*), or the Malayan *kaimanis*.⁵ Hippocrates⁶ employed cinnamon externally. Dioscorides⁷ describes several kinds of cinnamon.

BOTANY. *Gen. Char.*—*Flowers* hermaphrodite or polygamous. *Calyx* 6-cleft, with the limb deciduous. *Stamina* 12, in 4 rows; the 9 external ones fertile, the 3 inner ones capitate, abortive; the 3 most internal of the fertile stamina having 2 sessile glands at the base: *anthers* 4-celled, the 3 inner turned outwards. *Ovary* 1-celled, with 1 ovule. *Fruit* (a berry) seated on a cup-like calyx. *Leaves* ribbed. *Leaf-buds* naked. *Flowers* paniced, rarely fasciated. (Condensed from Endlicher.)⁸

Sp. Char.—*Branches* somewhat 4-cornered, smooth. *Leaves* ovate or ovate-oblong, tapering into an obtuse point, triple-nerved, or 3-nerved, reticulated on the under side, smooth, the uppermost the smallest. *Panicles* terminal and axillary, stalked. *Flowers* hoary and silky; segments oblong, deciduous in the middle (Nees).⁹

Botanists admit several varieties of this species; the most important are—

α. Broad-leaved, Moon;¹⁰ *Mupat* (Cingalese).—The plant above described.

β. Narrow-leaved, Moon; *Cinnamomum zeylanicum*, var. *γ*; *Cassia*, Nees; *Heen-pat* (Cingalese).—This variety, which I have received from Ceylon under the name of *Bastard Cinnamon*, has oblong or elliptical leaves, much tapering to the point, and acute at the base.

Percival¹¹ mentions four varieties which are barked: 1st, *Rasse curundu*, or *honey cinnamon*, with broad leaves, yields the best bark; 2dly, *Nai curundu*, or *snake cinnamon*, also with large leaves, not greatly inferior to the former; 3dly, *Capuru curundu*, or *camphor cinnamon*, an inferior kind; 4thly, *cabatte curundu*, or *astringent cinnamon*, with smaller leaves; its bark has a harsh taste.

Hab.—Cultivated in Ceylon and Java.

PRODUCTION.—The cinnamon bark of Ceylon is obtained by the cultivation of the plant. The principal *cinnamon gardens* lie in the neighbourhood of Columbo.¹²

¹ Crawford, *Hist. of the Ind. Archip.* vol. i. p. 510.

² *Pictorial Bible*, vol. i. p. 222.

³ Royle, *Essay on Hindoo Medicine*, pp. 84 and 141.

⁴ Lib. i. cap. 13.

⁵ *Systema Laurinarum*.

⁶ *Account of the Island of Ceylon*.

⁷ *Exod.* xxx. 23.

⁸ *Thalia*, cvii. and cxi.

⁹ Pp. 265, 575, and 609, ed. Fœs.

¹⁰ *Gen. Plant.*

¹¹ *Cat. of Ceylon Plants*.

¹² See Percival's *Account of Ceylon*, 2d ed. 1805.

Fig. 297.



Cinnamomum zeylanicum.

The bark-peelers, or *choliahs*, having selected a tree of the best quality, lop off such branches as are three years old, and which appear proper for the purpose. Shoots or branches, much less than half an inch, or more than two or three inches in diameter, are not peeled. The peeling is effected by making two opposite, or, when the branch is thick, three or four, longitudinal incisions, and then elevating the bark by introducing the peeling-knife beneath it. When the bark adheres firmly, its separation is promoted by friction with the handle of the knife. In twenty-four hours, the epidermis and greenish pulpy matter (*rete mucosum*) are carefully scraped off. In a few hours, the smaller quills are introduced into the larger ones, and in this way a congeries of quills formed, often measuring forty inches long. The bark is then dried in the sun, and afterwards made into bundles with pieces of split bamboo twigs.¹

Cinnamon walking-sticks.—The hazel-like walking-sticks, so much esteemed by visitors to Ceylon, are obtained from the shoots which spring almost perpendicularly from the roots after the parent bush or tree has been cut down.²

COMMERCE.—Cinnamon is imported in bales, boxes, and chests, from Ceylon principally; but in part also from Madras, Tellicherry, and rarely from Java and other places.

In order to preserve and improve the quality of the bark, black pepper is sprinkled among the bales of cinnamon in stowing them at Ceylon (Percival). Mr. Bennett states that ships are sometimes detained for several weeks, through the want of pepper to fill the interstices between the bales in the holds.

When cinnamon arrives in London, it is unpacked and examined; all the mouldy and broken pieces are removed from it. It is then re-made into bales. These are cylindrical, 3 feet 6 inches long, but of variable diameter, perhaps 16 inches on the average. These bales are enveloped by a coarse cloth, called *gunny*. The cinnamon in boxes and chests is usually the small, inferior, and mouldy pieces.

DESCRIPTION.—Four kinds of cinnamon³ are distinguished in the London market; namely, *Ceylon*, *Tellicherry*, *Malabar*, and *Java* cinnamon. The latter, however, is rarely met with. A fifth kind, called *Cayenne*, occurs in French commerce.

The *Chinese cinnamon* of continental writers is *Cassia lignea* of English commerce.

1. *Ceylon Cinnamon* (*Cinnamomum zeylanicum* seu *Cinnamomum acutum*).—This is the most esteemed kind. The fasciculi or compound quills, of which the bales are made up, are about 3 feet 6 inches long, slender, and shivery, and are composed of several smaller quills inclosed one within the other. The bark is thin (the finest being scarcely thicker than drawing paper), smooth, of a light yellow-brown or brownish-yellow, moderately pliable, with a splintery fracture, especially in the longitudinal direction. The inner side or *liber* is darker and browner, and contains, according to Nees, small medullary rays filled with a red juice, and which he regards as the peculiar bearers of the aroma. The odour of the bark is highly fragrant. The flavour is warm, sweetish, and agreeable. Inspection and tasting are the methods resorted to for ascertaining the qualities of cinnamon.⁴

Ceylon cinnamon is characterized by being cut obliquely at the bottom of the quill, whereas the other kinds are cut transversely. In the London market three qualities of Ceylon cinnamon are distinguished; viz. *first*, *seconds*, and *thirds*. Inferior kinds are thicker, darker, browner, and have a pungent, succeeded by a bitter taste.

Thin, very much convoluted, smaller quills being inclosed in larger ones. *Ph. Lond.*

2. *Tellicherry or Bombay Cinnamon* is grown on one estate only, at Tellicherry,

¹ Percival, *op. cit.*: and Marshall, in *Thomson's Ann. of Philosophy*, vol. x.

² Bennett, *Ceylon and its Capabilities*, 1843.

³ In the years 1839 and 1840, I examined above 1000 bales of cinnamon in the Dock warehouses. In 1840, I was kindly assisted in my examination by Mr. Carroll, of Mincing Lane, one of the most experienced London dealers, who attended with me, and from whom I derived much practical information.

⁴ See Percival, *op. supra cit.*; also, Marshall, *op. supra cit.*

by Mr. Brown, and is wholly consigned to Messrs. Forbes and Co. Only 120 or 130 bales are annually imported. In appearance it is equal to the Ceylon kinds; but the internal surface of the bark is more fibrous, and the flavour is inferior. It is superior to the Malabar variety.

3. Madras or Malabar Cinnamon is of inferior quality. It is grown, I am informed, on the Coromandel coast. It is coarser and inferior in flavour to the other kinds. In thickness it approximates to *Cassia lignea*. Its quality has annually deteriorated since its introduction into the market. It does not meet with a ready sale, and it is expected that its importation will cease.

4. Java Cinnamon.—This is said to be equal in quality to the Ceylon sort.¹

5. Cayenne Cinnamon.—This is unknown in the London market. Its volatile oil is more acrid and peppery than the oil from Ceylon cinnamon.²

SUBSTITUTION.—In commerce, *Cassia lignea* (called on the continent Chinese cinnamon) is frequently substituted for cinnamon. It is distinguished by its greater thickness, its short resinous fracture, its less delicacy but greater strength of flavour, its shorter quills, and its being packed in small bundles. Moreover, it may be distinguished chemically by the action of iodine on its infusion (see *infra*). The difference of flavour is best distinguished when the barks are ground to powder. The great consumers of cinnamon are the chocolate-makers of Spain, Italy, France, and Mexico, and by them the difference of flavour between cinnamon and cassia is readily detected. An extensive dealer in cinnamon informs me that the Germans, Turks, and Russians prefer cassia, and will not purchase cinnamon, the delicate flavour of which is not strong enough for them. In illustration of this, I was told that some cinnamon (valued at 3s. 6d. per lb.) having been by mistake sent to Constantinople, was unsaleable there at any price; while cassia lignea (worth about 6d. per lb.) was in great request.

COMPOSITION.—In 1817, Vauquelin³ made a comparative analysis of the cinnamons of Ceylon and Cayenne. The constituents of both were found to be *volatile oil, tannin, mucilage, colouring matter* (partially soluble in water and in alcohol, but insoluble in ether), *resin, an acid, and ligneous fibre*. Starch is a constituent of cinnamon, though not mentioned in this analysis.

CHEMICAL CHARACTERISTICS.—Sesquichloride of iron causes a greenish flocculent precipitate (*tannate of iron*) in infusion of cinnamon. Solution of gelatine also occasions a precipitate (*tannate of gelatine*) in the infusion.

A decoction of cinnamon may be distinguished from a decoction of cassia lignea by tincture of iodine; which gives a blue colour (*iodine of starch*) with the latter, but not with the former. Both barks contain starch, but cinnamon appears to contain a larger proportion of some principle (tannic acid?) which destroys the blue colour of iodide of starch; for, if the decoction of cassia lignea rendered blue by iodine be added to the decoction of cinnamon, the blue colour disappears.

PHYSIOLOGICAL EFFECTS.—Cinnamon produces the effects of the spices already described (see *ante*, p. 221). In moderate doses, it stimulates the stomach, produces a sensation of warmth in the epigastric region, and promotes the assimilative functions. The repeated use of it disposes to costiveness.

In full doses, it acts as a general stimulant to the vascular and nervous systems. Some writers regard it as acting specifically on the uterus.⁴

USES.—The uses of cinnamon are those of the species generally, and which have been before noticed. It is employed by the cook as an agreeable condiment. In medicine, it is frequently added to other substances: as to the bitter infusions, to improve their flavour; and to purgatives, to check their gripping qualities. As a cordial, stimulant, and tonic, it is indicated in all cases characterized by feebleness and atony. As an astringent, it is employed in diarrhoea, usually in combination with chalk, the vegetable infusions, or opium. As a cordial

¹ *Proceedings of the Committee of Commerce and Agriculture of the Asiatic Society*, p. 147.

² Vauquelin, *Journ. de Pharm.* t. iii. p. 434.

³ *Journ. de Pharmacie*, t. iii. p. 433.

⁴ Sundelin, *Heilmittel*. Bd. ii. S. 199, 3te Aufl.; and Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. ii. S. 137.

and stimulant, it is exhibited in the latter stages of low fever. In flatulent and spasmodic affections of the alimentary canal, it often proves a very efficient carminative and antispasmodic. It checks nausea and vomiting. It has also been used in uterine hemorrhage.

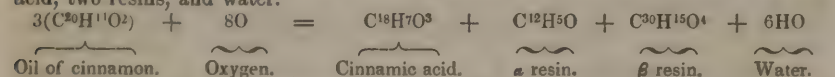
ADMINISTRATION.—The dose of it in substance is from ten grains to half a drachm.

1. **OLEUM CINNAMOMI**, L. E. D. [U. S.]; *Oleum Cinnamomi veri*, offic.; *Oil of Cinnamon*.—(Obtained in Ceylon by macerating the inferior pieces of the bark, reduced to a gross powder, in sea-water for two days, when both are submitted to distillation.)—As imported, the oil varies somewhat in its colour from yellow to cherry-red; the paler varieties are most esteemed; hence London druggists frequently submit the red oil of cinnamon to distillation, by which they procure two pale yellow oils; one lighter (amounting to about the quarter of the whole), the other heavier than water. The loss on this process is considerable, being near 10 per cent. Percival says that the oil obtained from the finer sorts of cinnamon is of a beautiful gold colour, while that from the coarser bark is darker and brownish.

Its odour is pleasant, and purely cinnamomic. Its taste is at first sweetish, afterwards cinnamomic, burning, and acrid.

Cinnamon oil of commerce is a complex substance, consisting of a mixture or compound of two or more bodies. The principal constituent, and which is considered to be cinnamon oil properly so called, is the *hydruret of cinnamyle*, whose formula, according to Mulder,¹ is $C^{20}H^{11}O^2$; but, according to Dumas and Peligot,² is $C^{18}H^8O^2$. Mulder³ supposes that the differences in these formulæ depend on the oil analyzed by Dumas and Peligot not having been quite fresh.

By exposure to the air, oil of cinnamon absorbs oxygen, and produces cinnamic acid, two resins, and water.



With nitric acid, oil of cinnamon combines to form a white crystalline nitrate ($C^{18}H^8O^3, NO^5$) and a red oil. With ammonia, the oil unites to form a crystalline solid amide, called *cinnahydramide*, whose formula is $C^{34}H^{24}N^2$.

On account of their great difference in commercial value, and resemblance in physical and chemical properties, oil of cassia is sometimes substituted for, or admixed with, genuine oil of cinnamon. The finer and more delicate odour of the latter is the chief distinction between them.

The Edinburgh College gives the following characters of oil of cinnamon:—

"Cherry-red when old; wine yellow when recent; odour purely cinnamomic: nitric acid converts it nearly into a uniform crystalline mass."

These characters, however, are not peculiar to this oil, as they are also possessed by oil of cassia.

Zetter⁴ says that oil of cinnamon is a thinner and specifically lighter oil, which does not become turbid at a lower temperature than the oil of cassia. Most, if not all, the other characteristic differences which he has given probably relate rather to particular samples of the oils than to their peculiar natures.

Oil of cinnamon root.—In 1848 some of this oil was imported. Its colour was pale yellow, and its odour that of cinnamon; but not so delicate as the oil of the bark.

Oil of cinnamon is sometimes employed as a powerful stimulant in paralysis of the tongue, in syncope, or in cramp of the stomach. But its principal use is as an adjuvant to other medicines. The dose of it is from one to three minims.

2. **OLEUM CINNAMOMI FOLIORUM**; *Oil of Cinnamon Leaf*.—It is exported from Ceylon, and is sometimes called, on account of its odour, *clove oil*.

¹ *Berlinisches Jahrbuch für d. Pharmacie*, Bd. xxxviii. p. 176, 1837.

² *Ann. de Chim. et de Phys.*

³ *Pharmaceutisches Central-Blatt für 1839*, p. 879.

⁴ *Jahrbuch für praktische Pharmacie*, Bd. xix. S. 3, and General-Tabelle, 1849.

I am informed by a gentleman on whose estate in Ceylon it is obtained, that it is procured by macerating the leaves in sea-water, and afterwards submitting both to distillation. It is a yellow liquid, heavier than water, and has an odour and taste analogous to those of oil of cloves.

Bennett¹ declares it to be equal in aromatic pungency to the oil made from the clove at the Molucca Islands. Oil of cinnamon leaf is, however, specifically lighter than genuine oil of cloves; but, like the latter, yields a dark blue colour with the tincture of the sesquichloride of iron. Its effects and uses are similar to those of oil of cloves.

3. **AQUA CINNAMOMI**, L. E. D. [U. S.]; *Cinnamon Water*.—(Cinnamon, bruised, ℥iiss; Water *Cong.* ij. Let a gallon distil. Or, Oil of Cinnamon ℥ij; Powdered Flint ℥ij; Distilled Water *Cong.* j. Diligently rub the oil, first with the flint, afterwards with the water, and strain the liquor, *L.*—Cinnamon Bark, bruised, ℥xviiij; Water two gallons; Rectified Spirit ℥iij. Mix them together, and distil off one gallon, *E.*—Essence of Cinnamon ℥ij; Distilled Water half a gallon. Mix with agitation, and filter through paper, *D.*—[Take Oil of Cinnamon ℥ss; Carbonate of Magnesia ℥j; Distilled Water Oij. Rub the oil of cinnamon, first with the carbonate of magnesia, then with the water gradually added, and filter through paper, *U. S.*].—Cinnamon water is principally employed as a vehicle for other medicines. It is aromatic and carminative. Gœppert says it is poisonous to plants. By dissolving iodine and iodide of potassium in cinnamon water, a crystalline compound is produced, consisting of iodide of potassium 12.55, iodine 28.14, oil of cinnamon 59.31.²

4. **SPIRITUS CINNAMOMI**, L. E.; *Spirit of Cinnamon*.—(Oil of Cinnamon ℥ij; Proof Spirit *Cong.* j; Water Oj. Dissolve, *L.*—Cinnamon, in coarse powder, ℥bj; Proof Spirit Oviij. Macerate for two days in a covered vessel; add a pint and a half of water; and distil off seven pints, *E.*)—Stimulant. Dose, ℥j to ℥iv.

5. **ESSENTIA CINNAMOMI**, D.; *Essence of Cinnamon*.—(Oil of Cinnamon ℥ij; Rectified Spirit ℥ix. Mix with agitation, *D.*)—Used for making cinnamon water. A few drops may be taken on a lump of sugar as a stimulant.

6. **TINCTURA CINNAMOMI**, L. E. [U. S.]; *Tincture of Cinnamon*.—(Cinnamon, bruised, ℥iijss [in moderately fine powder, *E.*]; Proof Spirit Oij [U. S.]. Macerate for seven days, and strain. [Proceed by percolation or digestion, as directed for tincture of cassia, *E.*])—Commonly used as an adjuvant to cretaceous, astringent, tonic, or purgative mixtures. It has also been employed in uterine hemorrhage.³ Dose, ℥j to ℥iv.

7. **TINCTURA CINNAMOMI COMPOSITA**, L. E. D. [U. S.]; *Compound Tincture of Cinnamon*.—(Cinnamon, bruised [in fine powder, if percolation be followed, *E.*], ℥j [℥ij, *D.*]; Cardamom, bruised, ℥ss [℥j, *E. D.*]; Long Pepper, powdered [ground finely, *E.*], ℥ijss [℥iij, *E.*] [not used by the *Dublin College*]; Ginger ℥ijss [not used by the *Ed. College* [℥ss, *D.*]]; Proof Spirit Oij. Macerate for seven [fourteen, *D. (U. S.)*] days, express and strain, *L.* "This tincture is best prepared by the method of percolation as directed for the compound tincture of cardamom. But it may also be made in the ordinary way by digestion for seven days, straining and expressing the liquor, and then filtering it," *E.* [The formula of the *U. S.* is like that of the *London Pharm.*])—Cordial and aromatic. Used in the same cases as the last. Dose, ℥j to ℥ij.

8. **PULVIS CINNAMOMI COMPOSITUS**, L.; *Pulvis Aromaticus*, E. D. [U. S.]; *Compound Powder of Cinnamon*; *Aromatic Powder*.—(Cinnamon ℥ij; Cardamom ℥iiss [℥j, *D. (U. S.)*]; Ginger ℥j [℥ij, *D.*]; [Long Pepper ℥ss, *L.*; Nutmeg ℥j, *D. (U. S.)*]. Rub them together, so that a very fine powder may be made, *L. D.*—

¹ *Ceylon and its Capabilities*, p. 70, 1413.

² *Apjohn, Athenæum*, No. 517, for 1837; and No. 559, 1838.

³ *Voigtels, Arzneim.* Bd. ii. S. 465.

The *Edinburgh College* employs cinnamon, cardamom seeds, and ginger, of each equal parts.)—Aromatic and carminative. Dose, grs. x to grs. xxx. Principally employed as a corrigent of other preparations.

9. CONFECTIO AROMATICA, L. D. [U. S.]; *Electuarium Aromaticum*, E.; *Aromatic Confection*.—(Cinnamon, Nutmegs, each ʒij; Cloves ʒj; Cardamom Seeds ʒss; Saffron ʒij; Prepared Chalk ʒxvj; Sugar lbij; Distilled Water as much as may be sufficient. Rub the dry ingredients together to a very fine powder, and preserve in a stoppered vessel. When the confection is required for use, add two fluidrachms of water to each ounce of the powder, and mix them together until they form one mass, *L.* The *Edinburgh College* orders of Aromatic Powder *one part*; Syrup of Orange Peel *two parts*. Mix and triturate them into a uniform pulp.—The *Dublin College* orders of Aromatic Powder ʒv; Dried Saffron, in fine powder, ʒss; Oil of Cloves fʒss; Simple Syrup fʒv; Clarified Honey, *by weight*, ʒij. Rub the aromatic powder with the saffron, add the syrup and honey, and beat them together till thoroughly mixed; lastly, add the Oil of Cloves.)—The preparation of the London Pharmacopœia differs essentially from the aromatic confection of the Edinburgh and Dublin Pharmacopœias, in not containing chalk. The London College directs the water to be added when the preparation is wanted, with the view of preventing fermentation, to which the preparation is subject. Some druggists substitute a strong infusion of saffron for the solid saffron; the volatile oil of the spices for the spices themselves; and precipitated carbonate of lime for chalk.

Aromatic confection, Ph. L., is antacid, stimulant, and carminative. It is usually added to the ordinary chalk mixture in diarrhœa, and is employed on various other occasions where spices are indicated. Dose, grs. x to ʒj.

[The *U. S. Pharm.* directs of Aromatic Powder five ounces and a half; Saffron, in powder, half an ounce; Syrup of Orange Peel six ounces; Clarified Honey two ounces.]

141. CINNAMOMUM CASSIA, Blume.—THE CINNAMON CASSIA.

Cinnamomum aromaticum, Nees.

Sex. Syst. Enneandria, Monogynia.

(Cassia-bark. Oil of Cassia, *E.*—Cassia lignea, and Cassia buds, *offic.*)

HISTORY.—It is highly probable that the bark, now called *cassia lignea*, was known to the ancient Greeks and Romans; but we cannot positively prove this. The barks termed by the ancients cinnamomum (κιννάμωμον) and cassia¹ (κάσσια), as well as the trees yielding these substances, are too imperfectly described to enable us to determine with precision the substances referred to. The cassia tree is called in Chinese *Kwei* (*Qui*). Cassia lignea is called *Kwei Pe*, or Cassia skin; while Cassia buds are termed *Kwei Tsze*, or Cassia seeds. Cinnamon is called *Yuh Kwei* (vulgarly Yoke Qui), or Precious Cassia. It is not a product of China.

BOTANY. *Gen. Char.*—Vide *Cinnamomum zeylanicum*.

Sp. Char.—*Leaves* opposite, sometimes alternate, oblong-lanceolate, triple-nerved; the nerves vanishing at the point of the leaf. *Petioles* and younger branches silky-tomentose. *Stem* arborescent (Blume).²

Hab.—China; cultivated in Java.

The tree known in Ceylon as the *Dawal Kurunda* was erroneously supposed by Linnæus to be the source of cassia bark, and hence he termed it *Laurus Cassia*. The Dublin College has been led into the same error. Many years since, Mr. Marshall³ stated that the bark of Dawul Kurunda was not aromatic like cinnamon, but had the bitter taste and the odour of myrrh.

¹ *Psalms* xlv. 9.

² *Ann. of Phil.* vol. x. 1817.

³ *Bijdrag.*

This tree is the *Litsæa Ceylanica* of recent botanists.¹ Mr. Marshall declares² that in Ceylon it is never decorticated, and that the coarse cinnamon (*i. e.* cinnamon procured from thick shoots or large branches of *Cinnamomum zeylanicum*) "has been imported into England, and sold under the denomination of cassia." It has been erroneously inferred from this statement that the cassia lignea of European commerce was merely coarse cinnamon; but if this were the case, it would be somewhat remarkable that cassia lignea is not imported from Ceylon. It is not at all improbable that coarse Ceylon cinnamon may have been sold in the London market as cassia lignea; but this by no means establishes the identity of the two barks. Such an occurrence can now scarcely happen, seeing that all cinnamon (coarse as well as fine) exported from Ceylon pays a duty of 3s. per lb, while the value of cassia lignea in bond is about 6d. per lb.

In the *Pun tsaou* (a Chinese herbal) is a drawing of the Cassia tree. It is represented growing on a hill, and as having a very crooked and knotted stem.

DESCRIPTION.—Two substances are believed to be obtained from this species; namely, the bark called *cassia lignea*, and the flower buds termed *cassia buds*.

1. Cassia lignea (*cortex cassiæ*) is regarded on the continent of Europe, and in America,³ as a sort of cinnamon. In English commerce, it is always distinguished. It is imported in chests. It resembles cinnamon in many of its qualities. It is made up in bundles, which are tied with slips of bamboo. It has the same general appearance, smell, and taste as cinnamon; but its substance is thicker, its appearance coarser, its colour darker, browner, and duller; its flavour, though cinnamomic, is much less sweet and fine than that of Ceylon cinnamon, but is more pungent, and is followed by a bitter taste; it is less closely quilled, and breaks shorter, than genuine cinnamon (see *ante*, p. 390). It is imported from Singapore, Calcutta, Bombay, and Manilla.

1. China cassia lignea (sometimes called *China cinnamon*) is the best kind. It is usually imported from Singapore, rarely from Canton direct. Mr. Reeves⁴ says vast quantities of both cassia buds and cassia lignea are annually brought to Canton from the province of Kwangse, whose principal city (*Kwei Lin Too*), literally the city of the Forest (or Grove) of Cassia trees, derives its name from the forests of cassia around it.

The Chinese themselves use a much thicker bark (which they call *Gan Kwei Pe*), unfit for the European market. Mr. Reeves informs me that they esteem it so highly as to pay nearly 10 dollars per lb. for it. A very fine quality is occasionally met with, and commands the enormous price of 100 dollars per catty (1½ lb.) A specimen of it, with which he has kindly furnished me, is straight, semi-cylindrical, 11 inches long, rather more than an inch wide, and about one-sixth or one-eighth of an inch thick. Externally it is warted, and covered with crustaceous lichens. Internally, it is deep brown. Its odour and flavour are those of cassia. Mr. Reeves also informs me that the best cassia lignea is cut in the 3d or 4th moon, the second sort in the 6th or 7th moon.

2. Malabar cassia lignea.—This is brought from Bombay. It is thicker and coarser than that of China, and is more subject to foul packing; hence each bundle requires separate inspection.⁵ It may, perhaps, be coarse cinnamon; for Dr. White states that the bark of the older branches of the genuine cinnamon plant is exported from the Malabar coast as cassia.

3. Manilla cassia lignea.—This, I am informed, is usually sold in bond for continental consumption. I have received a specimen of bark ticketed "Cassia vera from Manilla," the epidermis of which was imperfectly removed.

4. Mauritius cassia lignea.—This is occasionally met with.

2. Cassiæ buds (*flores cassiæ immaturæ; clavelli cinnamomi*) are not contained in any of the British Pharmacopœias. They are the produce of China, and are probably procured from the same plant which yields cassia lignea. Mr. Reeves

¹ C. G. Nees, ab Esenbeck, *Syst. Laurinarum*, Berol. 1836; also Dr. Wight, in Jameson's *Journal*, vol. xxviii. Edinb. 1840.

² *Annals of Philosophy*, vol. x. 1817.

³ In the American pharmacopœia, both cinnamon and cassia lignea are included under the name of cinnamon.

⁴ *Trans. Med. Bot. Society* for 1828, p. 26.

⁵ Milburn's *Orient. Com.*

tells me that he has always understood and has no doubt that both cassia buds and cassia lignea are obtained from the same trees. The buds are gathered, he informs me, in the 8th or 9th moon. Dr. T. W. C. Martius¹ says "that, according to the latest observations which the elder Nees has made known, cassia buds are the calyces (*Fruchtkelche*) of *Cinnamomum aromaticum*, about one-fourth of their normal size. It is also said that they are collected from *Cinnamomum dulce* (Nees), which is found in China." Cassia buds bear some resemblance to cloves, but are smaller, or to nails with round heads; they have the odour and flavour of cassia lignea or cinnamon. The exports from Canton in 1831 were 177,866 lbs., and the imports into Great Britain in 1832 were 75,173 lbs.² In 1840, 6,406 lbs. paid duty. Cassia buds have not yet been analyzed; their constituents are similar to those of cassia lignea; they yield a volatile oil by distillation, and contain tannic acid.

COMPOSITION.—*Cassia lignea* was analyzed by Bucholz,³ who obtained the following results: Volatile oil, 0.8; resin, 4.0; gummy (astringent) extractive, 14.6; woody fibre with bassorin, 64.3; water and loss, 16.3 = 100.0.

CHEMICAL CHARACTERISTICS.—Sesquichloride of iron renders decoction of cassia lignea dark green, and causes a precipitate (*tannate of iron*). Gelatine also produces a precipitate (*tannate of gelatine*). If tincture of iodine be added to it, a blue colour (*iodide of starch*) is produced. By this cassia lignea may be distinguished from genuine cinnamon (see *ante*, p. 389).

PHYSIOLOGICAL EFFECTS.—Similar to those of cinnamon. Sundelin⁴ regards it as being more astringent.

USES.—Are the same as those of cinnamon.

ADMINISTRATION.—Dose, grs. x to ʒss.

1. OLEUM CASSIÆ, E.; *Oil of Cassia*; *Oil of Chinese Cinnamon*.—(Obtained from cassia lignea by distillation with water.)—Its properties and composition are similar to those of oil of cinnamon, before described (see *ante*, p. 391). Its odour and flavour, however, are inferior to those of the latter. Its colour is usually pale yellow. Nitric acid converts it into a crystalline mass. Its effects and uses are similar to those of oil of cinnamon. It is employed in the preparation of *Aqua* and *Spiritus Cassiæ*.—Dose, gtt. j to gtt. iv.

2. AQUA CASSIÆ, E.; *Cassia Water*.—(Cassia bark, bruised, ʒxviii; Water *Cong.* ij; Rectified Spirit fʒij. Mix them together, and distil off one gallon.)—Used as an aromatic vehicle for other medicines. It is usually prepared from the oil in the same way that cinnamon water is commonly made.

3. SPIRITUS CASSIÆ, E.; *Spirit of Cassia*.—(Cassia, in coarse powder, ℥bj; Proof Spirit Ovij. Macerate for two days in a covered vessel, add a pint and a half of water, and distil off seven pints.)—Dose fʒj to fʒiv. It is usually prepared by adding oil of cassia to proof spirit.

4. TINCTURA CASSIÆ, E.; *Tincture of Cassia*.—(Cassia, in moderately fine powder, ʒiijss; Proof Spirit Oij. Digest for seven days, strain, express the residuum strongly, and filter. This tincture is more conveniently made by the process of percolation, the cassia being allowed to macerate in a little of the spirit for twelve hours before being put into the percolator.)—Dose fʒj to fʒij. Used as an adjuvant to tonic infusions.

¹ *Pharmacognosie*, S. 213.

² McCulloch's *Dict. of Comm.*

³ *Parliam. Returns*, No. 50, Sess. 1829; No. 367, Sess. 1832; No. 550, Sess. 1833.

⁴ *Helmiittell.* Bd. ii. S. 119, 3tte Aufl.

142. CAMPHORA OFFICINARUM, *Nees*.—THE CAMPHOR LAUREL.

Laurus Camphora, *Linn.*

Sez. Syst. Enneandria, Monogynia.

(Concretum e ligno sublimatione comparatum, purificatum, *J.*—Camphor, *E. D.*)

HISTORY.—The ancient Greeks and Romans do not appear to have been acquainted with camphor. C. Bauhin and several subsequent writers state that Aëtius speaks of it; but I have been unable to find any notice of it in his writings; and others¹ have been equally unsuccessful in their search for it. Avicenna² and Serapion³ call it *cáfúr*; the latter erroneously cites Dioscorides. Symeon Seth,⁴ who lived in the 11th century, describes it, and calls it *καφουρά* (the name by which it is designated in the *Pharmacopœia Græca*, 1837); and his description is considered, both by Voigtels⁵ and Sprengel⁶, to be the earliest on record.

BOTANY. **Gen. Char.**—*Flowers* hermaphrodite, panicled, naked. *Calyx* 6-cleft, papery, with a deciduous limb. *Fertile stamens* 9, in 3 rows; the inner with 2, stalked, compressed glands at the base; *anthers* 4-celled, the outer turned inwards, the inner outwards. 3 *sterile stamens*, shaped like the last, placed in a whorl alternating with the stamens of the second row; 3 others stalked, with an ovate, glandular head. *Fruit* placed on the obovate base of the calyx. *Leaves* triple-nerved, glandular in the axils of the principal veins. *Leaf-buds* scaly (Lindley).

Sp. Char.—*Leaves* triple-nerved, shining above, glandular in the axils of the veins. *Panicles* axillary and terminal, corymbose, naked.

Flowers smooth on the outside (Nees).

Young *branches* yellow and smooth. *Leaves* evergreen, oval, acuminate, attenuate at the base, bright green and shining above, paler beneath. *Petioles* from 1 to 1½ inches long. *Panicles* axillary and terminal, corymbose. *Flowers* small, yellowish-white. *Berry* round, blackish-red, size of a black currant. *Seed* solitary.

Every part of the tree, but especially the flower, evinces by its smell and taste that it is strongly impregnated with camphor.

Hab.—China, Japan, and Cochin-China. Introduced into Java from Japan.

EXTRACTION AND DESCRIPTION.—Two kinds of *unrefined* or *crude camphor* (*camphora cruda* vel *rudis*) are known in commerce; one is the produce of Japan, the other of China.

1. Japan Camphor.—This is always brought to Europe by the Dutch, and is, therefore, called *Dutch camphor*.

Kæmpfer⁷ and Thunberg⁸ have described the method of extracting this kind of camphor in the provinces of Satzuma, and the islands of Gotho in Japan. The roots and wood of the tree, chopped up, are boiled with water in an iron vessel, to which an earthen head, containing straw, is adapted. The camphor sublimes and condenses on the straw.

Japan or Dutch camphor is brought to Europe by way of Batavia. It is imported in tubs (hence it is called *tub camphor*) covered by matting, and each surrounded by a second tub, secured on the outside by hoops of twisted cane. Each tub contains from 1 cwt. to 1½ cwt. or more. It consists of pinkish grains, which, by their mutual adhesion, form various-sized masses. It differs from the ordinary crude camphor in having larger grains, in being cleaner, and in subliming (usually) at a lower temperature. In consequence of these properties, it generally fetches 10s. per cwt. more. There is not much brought to England, and of that which does come the greater part is re-shipped for the continent.

¹ Alston, *Lect. on the Mat. Med.* vol. ii. p. 406.

² *De temp. simpl.* cccxxxiv.

³ *Arzneim.* Bd. i. S. 83.

⁴ *Amœn. Exot.* p. 772.

⁵ *Lib. ii. tract. ii. cap. 134.*

⁶ *De aliment. facult.*

⁷ *Hist. de la Méd.* t. ii. p. 225.

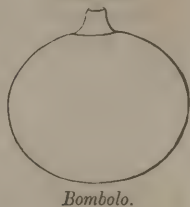
⁸ *Fl. Japonica.*

2. China Camphor; Formosa Camphor.—This is the *ordinary crude camphor*. The method of obtaining crude camphor in China has been described by the Abbé Grosier,¹ Dentrecolles,² and Davis.³ The chopped branches are steeped in water, and afterwards boiled, until the camphor begins to adhere to the stick used in stirring. The liquid is then strained, and, by standing, the camphor concretes. Alternate layers of a dry earth, finely powdered, and of this camphor, are then placed in a copper basin, to which another inverted one is luted, and sublimation effected.

This kind of crude camphor is imported from Singapore, Bombay, &c., in square chests lined with lead-foil, and containing from $1\frac{1}{4}$ to $1\frac{1}{2}$ cwt. It is chiefly produced in the island of Formosa, and is brought by the Chin-Chew junks in very large quantities to Canton, whence foreign markets get supplied.* It consists of dirty grayish grains, which are smaller than those of Dutch camphor. Its quality varies; sometimes it is wet and impure, but occasionally it is as fine as the Dutch kind.

REFINEMENT.—Crude camphor is refined by sublimation. Formerly, this process was carried on only at Venice. Afterwards, it was successfully practised in Holland.⁵ The method at present adopted in this metropolis is, as I am informed, as follows:⁶ The vessels in which this sublimation is effected are called *bomboloes* (bombola, *Ital.* βομβολιός). They are made of thin flint glass, and weigh about 1 lb. each. Their shape is that of an oblate spheroid, whose shorter or vertical axis is about ten inches, and the longer or horizontal axis about twelve inches. They are furnished with a short neck.⁷ When filled with crude camphor, they are imbedded in the sand-bath, and heated. To the melted camphor lime is added, and heat raised so as to make the liquid boil. The vapour condenses on the upper part of the vessel. As the sublimation proceeds, the height of the sand around the vessel is diminished. In about forty-eight hours the process is usually completed. The vessels are then removed, and their mouths clothed with tow; water is sprinkled over them by watering-pots, by which they are cracked. When quite cold, the cake of camphor (which weighs about eleven pounds) is removed, and trimmed by paring and scraping. In this process the lime retains the impurities and a portion of the camphor; hence, to extract the latter, the lime is submitted to a strong heat in an iron pot with a head to it, and the sublimed product refined by a second sublimation.

Fig. 298.



Bombolo.

PROPERTIES.—*Refined Camphor* (*camphora raffinata vel elaborata*; *camphora*, officin.) is met with in the form of large hemispherical or convex-concave cakes, perforated in the middle. It is translucent, has a crystalline granular texture;⁸ a strong, peculiar, not disagreeable, aromatic odour, and an aromatic, bitter, afterwards cooling taste. It is solid at ordinary temperatures, soft, and somewhat tough, but may be readily powdered by the addition of a few drops of rectified spirit. It evaporates in the air at ordinary temperatures; but in closed vessels, exposed to light, sublimes and crystallizes on the sides of the bottle. It burns in the air like the volatile oils generally. It fuses at 347° F., and forms a transparent liquid, which boils at 400° F., and in close vessels condenses unchanged. It is lighter

¹ *Hist. Gen. de la Chine*, t. xiii. p. 335.

² *The Chinese*, vol. ii. p. 355, 1835.

³ Reeves, *Trans. Med. Bot. Soc.* for 1838, p. 26; Gutzlaff and Reed, *China Opened*, vol. ii. p. 84, 1838.

⁴ Ferber (*Journ. de Pharm.* t. i. p. 136, 1815) has described the refining process as practised by the Dutch.

⁵ Bosc, in his *Elaboratory laid Open*, 1758, has described the mode of refining camphor.

⁶ Chevreul (*Journ. de Pharm.* t. iii. p. 321, 1817) has described and figured another sort of subliming apparatus. 2½ lbs. of crude camphor, mixed with 6 drachms of powdered quick lime, are placed in a flat-bottomed squat bottle, with a short neck, on a sand-bath: the neck of the bottle fits into a conical tin-plate head, into which the camphor is sublimed.

⁷ A crystal of native camphor in the wood (probably not laurel camphor, but Borneo or dryobalanops camphor) in the collection of Materia Medica at the College of Physicians, appears as a flat octohedron, but its primary form is a right rhombic prism (W. Phillips, in Paris's *Pharmacologia*).

⁸ Quoted by Davis.

than water, its sp. gr. being 0.9867; or, according to some, 0.996.¹ Small pieces, when thrown on this liquid, are violently agitated, and present a gyratory motion, which ceases directly a drop of oil is let fall on the water. If a cylinder of camphor, of the $\frac{1}{4}$ th or $\frac{1}{5}$ th of an inch in diameter, be placed vertically in water, it communicates a to-and-fro movement to this liquid, and, in a few days, becomes cut through at the surface of the water. These phenomena are due to the simultaneous evaporation of the camphor and water, and which is most active where the two bodies are in contact.

Camphor is but very slightly soluble in water; 1000 parts of the latter dissolving only one part of camphor at the ordinary pressure of the atmosphere. But under augmented pressure it becomes more soluble.

Alcohol readily dissolves camphor; but if water be added to the solution, the camphor is precipitated. Ether, bisulphuret of carbon, the oils (both fixed and volatile), and the acids, also dissolve it. The liquid obtained by dissolving camphor in nitric acid is sometimes termed *camphor oil*: it is a *nitrate of camphor*, and is decomposed by water, the camphor being precipitated. The camphor absorbs sulphurous and hydrochloric acid gases, with which it unites and forms respectively a *sulphite* and a *hydrochlorate of camphor*. Camphor is insoluble in alkaline solutions. The vapour of camphor passed over red-hot lime is converted into naphthaline, and an oily liquid called *camphrone*.

COMPOSITION.—Camphor has the following composition:—

	Atoms.	Eq. Wt.	Per cent.	Dumas.	Blanchet and Sell.
Carbon	20	120	78.94	78.02	77.96
Hydrogen	16	16	10.53	10.39	10.61
Oxygen	2	16	10.53	11.59	11.43
Camphor	1	152	100.00	100.00	100.00

Dumas has suggested that camphor may be regarded as an oxide of a base (as yet hypothetical) which he calls *camphogen*, and whose composition is $C^{10}H^8$.

CHEMICAL CHARACTERISTICS.—In its combustibility, volatility, powerful odour, solubility in alcohol and ether, and almost insolubility in water, camphor agrees with the volatile oils. Being concrete or solid at ordinary temperatures, it obviously belongs to the class of *stearoptenes*, or *solid volatile oils*.

It is further distinguished by the remarkable character of its odour, by its not blackening in burning, and by its not being converted into resin by the oxygen of the air or by nitric acid. By repeatedly distilling nitric acid from camphor, the latter is converted into *camphoric acid* ($C^{20}H^{14}O^6, 2HO$). Before the whole of the camphor has been converted into camphoric acid, there are produced intermediate compounds of camphor and this acid, which we may regard as camphorates of camphor.

The camphor which we have now described may be designated *common* or *laurel camphor*, in order to distinguish it from *Borneo camphor*, or *camphor of the Dryobalanops*, as well as from *artificial camphor* (see *ante*, p. 294).

Common or laurel camphor absorbs hydrochloric acid gas, and forms a transparent, colourless liquid; Borneo camphor, on the contrary, is scarcely acted on by this acid gas. If Borneo camphor be boiled in nitric acid, it is converted into common camphor.

Artificial camphor (see *ante*, p. 294) usually evolves some hydrochloric acid when volatilized, and burns in the air with a greenish sooty flame: if the flame be blown out, the evolved vapour has a terebinthinate odour. By these characters, artificial camphor may be distinguished from laurel camphor.

OIL OF LAUREL CAMPHOR.—Pelouze and Freiny state that when the branches of *Camphora officinarum* are distilled with water, a mixture of camphor and a liquid essential oil is obtained, which is called *oil of camphor*.—This oil has a density of 0.919: its composition is $C^{22}H^{40}O$.

¹ The density of camphor varies considerably, according to the temperature. At 32° it is said to be denser than water (*Pharmaceutical Journal*, vol. v. p. 473, 1846).

By exposure to oxygen gas, or to the action of nitric acid, it absorbs oxygen and becomes solid camphor, $C^{26}H^{16}O^2$. It is probable, therefore, that its formation precedes that of solid camphor in the camphor tree. I have met with this oil in commerce under the name of *oil of camphor*. By keeping, it deposits crystals of camphor, and, from this circumstance, may be distinguished from the *oil of Lorano camphor* (see *Dryobalanops*). By the action of hydrochloric acid, I find that these crystals liquefy, like common or laurel camphor. A considerable quantity of the oil was purchased some years ago by a London manufacturer of scented soap, who submitted it to distillation, and obtained from 60 lbs. of it, 40 lbs. of colourless liquid oil, and 20 lbs. of crystalline camphor. The oil has been described and analyzed by Dr. Th. Martius.¹

PHYSIOLOGICAL EFFECTS. *a. On Vegetables*.—Gœppert² has satisfactorily shown—first, that solutions of camphor act in the same deleterious manner on plants as the volatile oils; secondly, that they destroy the mobility of contractile parts without previously exciting them; thirdly, that they have no influence either on the germination of phanerogamia, or the vegetation of the cellular cryptogamia; and fourthly, that the vapour only is sufficient to destroy fleshy plants and ferns. Miquet³ has confirmed these results.

β. On Animals generally.—The action of camphor on animals has been the subject of numerous experiments made by Hillefeld,⁴ Monro,⁵ Menghini and Carminati,⁶ Viborg, Hertwich,⁷ Orfila,⁸ and Scudery.⁹

Air impregnated with the vapour of camphor proves injurious to *insects* (the *Tineæ*, which destroy wool, excepted). Sooner or later it causes frequent agitation, followed by languor, insensibility, convulsions, and death (Menghini). To *amphibials* (frogs) the vapour also proves noxious. It produces preternatural movements, difficult respiration, trembling, and stupor (Carminati). Given to *birds* and *mammals*, in sufficient doses, camphor proves poisonous; but the symptoms which it gives rise to do not appear to be uniform. Indeed, there are few remedies whose action on the animal economy is so variable as that of camphor. Three drachms dissolved in oil and given to a dog, the œsophagus being tied, caused violent convulsions, somewhat analogous to those of epilepsy, followed by insensibility and death (Orfila). When administered in substance, it inflamed the digestive tube, caused ulceration, and, after its absorption, gave rise to convulsions (*Ibid.*). Given to horses, in doses of two drachms, it excites spasmodic movements, and quickens the pulse, but does not determine any serious result.¹⁰ Tiedemann and Gmelin¹¹ detected the odour of camphor in the blood of the vena portæ and of the mesenteric vein of a horse to whom they had given camphor; but they could recognize it neither in the chyle nor in the urine. It is evolved from the system principally by the bronchial surfaces; for the breath of animals to which this substance has been administered has a strong odour of camphor. Moiroud¹² observed that the skin of a horse, into whose jugular vein camphor had been injected, smelt of this substance.

“The general sedative effects of camphor on animals are rarely well marked; however, when administered in a proper dose, and in cases really requiring its use, it sometimes causes a diminution in the force and frequency of the pulse, and seems to allay pain” (Moiroud).

Scudery¹³ observed that the convulsions caused in animals by camphor were accompanied with a peculiar kind of delirium, which caused them to run up and down without apparent cause. He also found the urinary organs generally affected, and for the most part with strangury.

γ. On Man.—No article of the materia medica has had more contradictory state-

¹ *Berlinisches Jahrbuch für d. Pharmacie*, Bd. xl. S. 455, 1838.

² Poggendorff, *Ann. d. Phys. u. Chem.* 1828.

³ Meven's *Report on the Progress of Vegetable Physiology during the year 1837*, p. 139, translated by W. Francis.

⁴ Quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 215.

⁵ *Essays and Observ. Phys. and Lit.* vol. iii. p. 351.

⁶ *Ibid.*

⁷ Wibmer, *op. cit.*

⁸ Moiroud, *Pharm. Vétér.*

⁹ *Versuch d. Weg auf welchen Subst. aus d. Mag. u. Darmk. ins Blut gelang* S. 24 and 25.

¹⁰ *Op. cit.*

¹¹ Wibmer, *loc. cit.*

¹² *Toxicol. Gén.*

¹³ Quoted by Dr. Christison.

ments made respecting its effects and mode of action than camphor. These, however, have principally referred to its influence over the functions of circulation and calorification; for, with regard to the modifications which it induces in the other functions, scarcely any difference of opinion prevails.

Its local action on the mucous surfaces, the denuded dermis, and ulcers, is that of an *acrid*. A piece of camphor held in the mouth for half an hour caused the mucous lining of this cavity to become red, hot, swollen, and painful; and it is highly probable that, had the experiment been persevered in, ulceration would have followed.¹ The pain and uneasiness which camphor, when swallowed in substance, sometimes produces in the stomach, are likewise imputed to its local action as an *acrid*. Rubbed on the skin covered with cuticle, Dr. Cullen says that it causes neither redness nor other mark of inflammation;² but Dr. Clutterbuck³ declares this to be "undoubtedly a mistake." When applied to the denuded dermis, or to ulcers, it produces pain, and appears to act as an irritant. These observations respecting the local action of camphor on man are confirmed by the ascertained effects of this substance on other animals.

Camphor has been charged with producing brittleness of the teeth when it has been used for a considerable time as a dentifrice,⁴ but I believe without any valid foundation.

Camphor becomes absorbed, and is thrown out of the system by the bronchial membrane principally, but also by the skin. Trousseau and Pidoux⁵ recognized its odour in every case in the pulmonary exhalation, but failed to detect it in the cutaneous perspiration. Cullen, however, says⁶ that "Mr. Lasonne, the father, has observed, as I have done frequently, that camphor, though given very largely, never discovers its smell in the urine, whilst it frequently does in the perspiration and sweat." The non-detection of it in the urine agrees with the observation of Tiedemann and Gmelin with regard to horses, already noticed.

Camphor specifically affects the nervous system.—Regarding the symptoms of this effect, but little difference of opinion prevails. In moderate doses, it exhilarates and acts as an anodyne.⁷ Its exhilarating effects are well seen in nervous and hypochondriacal cases (see vol. i. p. 237). In large doses, it causes disorder of the mental faculties, the external senses, and volition; the symptoms being lassitude, giddiness, confusion of ideas and disordered vision, noise in the ears, drowsiness, delirium or stupor, and convulsions. These phenomena, which have been observed in several cases, agree with those noticed in experiments on brutes. In its power of causing stupor, camphor agrees with opium; but it differs from the latter in its more frequently causing delirium and convulsions. Epilepsy has been ascribed to the use of camphor.

The quality of the influence which camphor exercises over the vascular system has been a subject of much contention. From my own limited observations of its use in small or medium doses (from five to ten grains), I am disposed to regard its leading effect as that of a vascular excitant, though I am not prepared to deny that slight depression may not have preceded this effect. Combined with diaphoretic regimen (warm clothing and tepid diluents), I have seen camphor increase the fullness of the pulse, raise the temperature of the surface, and operate as a sudorific. If opium be conjoined, these effects are more manifest.⁸

In excessive doses, it acts as a powerful poison. The best related case is that of Mr. Alexander,⁹ who swallowed two scruples in syrup of roses. In about twenty minutes, he experienced lassitude and depression of spirits, with frequent yawnings:

¹ Trousseau and Pidoux, *Traité de Thérap.* t. i. p. 43.

² *Mat. Med.* vol. ii. p. 299.

³ *Inquiry into the Seat and Nature of Fever*, 2d edit. p. 421.

⁴ See *Lond. Med. Gazette*, N. S. vols. iii. and iv. 1846-7; and *Pharmaceutical Journal*, vol. vi. p. 234. 1846.

⁵ *Op. supra cit.* p. 49.

⁶ *Op. cit.* p. 305.

⁷ Harrop, *On the Anodyne Effects of Camphor*, in *The London Medical Review*, vol. iv. p. 200, Lond. 1800.

⁸ See p. 427, for some remarks on the comparative operation of ammonia and camphor.

⁹ *Experimental Essays*, p. 128, 1768.

at the end of three-quarters of an hour his pulse had fallen from 77 to 67. Soon after he felt giddy, confused, and almost incapable of walking across the room. He became gradually insensible, and in this condition was attacked with violent convulsions and maniacal delirium. From this state he awoke as from a profound sleep; his pulse was 100, and he was able to reply to interrogatories, though he had not completely recovered his recollection. Warm water being administered, he vomited up the greater part of the camphor, which had been swallowed three hours previously; and from this time he gradually recovered.

In another case,¹ a man swallowed four ounces of camphorated spirits containing 160 grains of camphor. The symptoms were burning heat of skin, frequent, full, and hard pulse, brilliancy of the eyes, redness of the face, heaviness of the head, anxiety, agitation, violent sense of heat in the stomach; then intense headache, giddiness, indistinctness of sight, and ocular hallucinations. The patient complained of heat only, which he said was intolerable. In the night, copious sweating came on, followed by sleep. The pulse continued full and frequent, and the voiding of urine difficult.

In some other well-reported cases, camphor, in large doses, caused depression of the vascular system. In the instance related by Fred. Hoffmann,² Pouteau,³ Griffin,⁴ Cullen,⁵ Callisen,⁶ Edwards,⁷ and Trousseau and Pidoux,⁸ sedation of the vascular system was observed. It was manifested by a languid, small, and slower pulse, coldness of the surface, and pallid countenance; in some cases with cold sweat. In some of these instances, symptoms of vascular excitement followed those of depression. The pulse became more frequent and fuller than natural, and the heat of the surface augmented. Trousseau and Pidoux⁹ ascribe the symptoms of sedation to the depressing influence which camphor exerts over the system by sympathy; while the sanguineous excitation they refer to the passage of camphor into the blood, and the efforts of the organism to eliminate this unassimilable principle. But in some of the cases in which excessive doses of camphor have been taken, no symptoms of depression were manifested; as in the instance mentioned by Dr. Eickhorn (in whom great heat, rapid but small pulse, copious sweating, and agreeable exhilaration, were produced by 120 grains),¹⁰ by Dr. Wendt,¹¹ by Seudery,¹² and by Bergondi.¹³

Camphor has long been celebrated as an anaphrodisiac; the smell of it even is said to be attended with this effect; hence the verse of the School of Salerno—*"Camphora per uires castrat odore mares."* Trousseau and Pidoux¹⁴ experienced the anaphrodisiac property of 36 grains of camphor taken into the stomach.

Strangury has also been ascribed to this substance by Heberden,¹⁵ by Seudery,¹⁶ and others.

USES.—The discrepancy among authors as to the physiological effects of camphor has had the effect of greatly circumscribing the use of this substance. Indeed, until its operation on the system be more satisfactorily ascertained, it is almost impossible to lay down general rules which should govern its exhibition. The following are the principal maladies in which it has been found useful:—

1. *Fever*.—Camphor has been employed in those forms of fever which are of a typhoid type. It is chiefly valuable by causing determination to the surface, and giving rise to diaphoresis. Hence those remedies should be conjoined with it which promote these effects: such are ipecacuanha, emetic tartar, and the vegetable alkaline salts. Opium greatly contributes to the sudorific effects of camphor; and, when it is admissible, benefit is sometimes obtained by the administration of one

¹ *Lond. Med. Gaz.* vol. v. p. 635, from Rust's *Magazin*.

² *Op. omnia*, t. iv. p. 26, Geneva, 1718.

³ Quoted by Alexander.

⁴ Murray, *App. Med.*

⁵ *Traité de Thérap.* t. i. p. 48.

⁶ *Lond. Med. Gaz.* vol. xi. p. 772.

⁷ Wilmor, *op. supra cit.*

⁸ *Op. cit.* p. 45.

⁹ *Supra cit.*

¹⁰ Murray, *App. Med.* vol. iv.

¹¹ *Mat. Med.* vol. ii. p. 295.

¹² Orfila, *Tox. Gén.*

¹³ *Op. cit.* p. 51.

¹⁴ Quoted in Dr. Christison's *Treatise on Poisons*, p. 810.

¹⁵ *Ibid.*

¹⁶ *Comment. art. Stranguria.*

grain of opium with five or eight of camphor. But in a great number of cases of fever, the cerebral disorder forbids the use of opium. From its specific influence over the cerebral functions, camphor has been frequently used in fever to allay the nervous symptoms—such as the delirium, the watchings, the subsultus tendinum, &c.; but it frequently fails to give relief. Dr. Home¹ did not find any advantage from its use in the low nervous fever; and Dr. Heberden² has seen one scruple of camphor given every six hours, without any perceptible effect in abating the convulsive catchings, or composing the patient to rest.

2. *In inflammatory diseases.*—In the latter stages of inflammation of internal important parts (as the serous and mucous membranes, the stomach, intestines, uterus, &c.), after proper evacuations had been made in the earlier periods of the disease, when great exhaustion is manifested by a small feeble pulse and a cold flaccid skin, small but repeated doses of camphor have been employed to determine to the skin, and to promote diaphoresis. It is particularly serviceable in rheumatic inflammation, and especially when produced by metastasis.³

3. *In the exanthemata.*—Camphor has been employed in smallpox, as also in measles, scarlatina, and miliary fever: but it is admissible only when the circulation flags, and the temperature of the surface falls below the natural standard. In such cases it is sometimes employed along with a diaphoretic regimen to determine to the skin. It is to be carefully avoided when inflammation of the brain or its membranes is feared. It has been asserted that if a camphorated ointment be applied to the face, no smallpox pustules will make their appearance there; but the statement is not correct.

4. *In mania, melancholia, and other forms of mental disorder.*—Camphor is occasionally taken to cause exhilaration. I am acquainted with two persons (females), both of nervous temperament, who use it for this purpose. To relieve despondency I have often found it serviceable. In mania and melancholia, it has now and then proved serviceable by its narcotic effects: it induces mental quiet, and causes sleep. It was used in these affections by Paracelsus and several succeeding writers,⁴ especially, in more modern times, by Dr. Kinneir;⁵ and by Avenbrugger.⁶ The latter regards it as a specific in the mania of men, when accompanied with a small contracted penis, corrugated empty scrotum, or when both testicles are so retracted that they appear to be introduced into the abdominal cavity.

5. *In spasmodic affections.*—The narcotic influence of camphor has occasionally proved serviceable in some spasmodic or convulsive affections; viz., spasmodic cough, epilepsy, puerperal convulsions, hysteria, and even tetanus: its use, however, requires caution.

6. *In irritation of the urinary or sexual organs.*—A power of diminishing irritation of the urinary organs has long been assigned to camphor. In strangury and dysury, especially when produced by cantharides, it is said to have been used with benefit—a statement apparently inconsistent with that more recently made of its producing irritation of the urinary organs. In satyriasis, nymphomania, and onanism, it is said to have proved advantageous by its anaphrodisiac properties. In dysmenorrhœa, it sometimes proves serviceable as an anodyne.

7. *In poisoning.*—Small doses of camphor (administered by the mouth or by the rectum) have been exhibited with apparent benefit in cases of poisoning by opium.⁷ It has also been employed to mitigate the effects of cantharides, squills, and mezereon;⁸ but toxicologists, for the most part, do not admit its efficacy: at any rate, further evidence is required to establish it. Nor does there appear any valid testimony for believing that camphor possesses the power of checking mercurial salivation, as some have supposed.

8. *In chronic rheumatism and gout.*—A mixture of camphor and opium, in the

¹ *Clin. Hist.* p. 36.

² Sundelin, *Handb. d. spec. Heilmittell.* Bd. ii. S. 145.

³ *Phil. Trans.* vol. xxxv.

⁴ *Experim. de remed. specif. in mania virorum*, Vind. 1776.

⁵ Hahnemann, and Van Bavegem, in Marx's *Die Lehre v. d. Giften*, Bd. ii. S. 202 and 353.

⁶ *Comment. art. Febris.*

⁷ Murray, *App. Med.* vol. iv. p. 499.

⁸ Orfila, *Toxicol. Gén.*

proportions before mentioned, is useful in chronic rheumatism, by its sudorific and anodyne properties. Warm clothing and diluents should be conjoined. In chronic gout, also, camphor is said to have proved beneficial.

9. *In cholera*.—The combination of camphor and opium above referred to, I have seen used with benefit in cholera.

10. *Externally*, camphor is employed in the form of vapour, in solution, or, more rarely, in the solid state. The *vapour* is occasionally inhaled in spasmodic cough; and is applied to the skin to alleviate pain and promote sweat, constituting the *camphor fumigations* (*fumigationes camphoræ*). Dupasquier¹ recommended these fumigations in chronic rheumatism. The patient may be in bed or seated in a chair; and, in either case, is to be enveloped by a blanket tied round the neck. About half an ounce of camphor is then to be placed on a metallic plate, and introduced within the blanket (under the chair, if the patient be seated). In *solution*, camphor is used either as an anodyne or a local stimulant. The nitric solution of camphor is used to relieve toothache. A solution of camphor in oil has been used as an injection into the urethra, to relieve ardor urinæ in gonorrhœa, and into the rectum to mitigate tenesmus arising from ascarides or dysentery. The acetic and alcoholic solutions of camphor are mostly employed as stimulants. In *substance*, camphor is not frequently used. A scruple or half a drachm “added to a poultice, and applied to the perineum, allays the chordee, which is a painful attendant upon gonorrhœa.”² Powdered camphor is a constituent of some tooth-powders, to which it communicates its peculiar odour.

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ANTIDOTE.—In a case of poisoning by camphor, first evacuate the contents of the stomach. Hufeland⁶ recommends the use of opium to relieve the effects of camphor. Phœbus⁷ directs chlorine water to be administered as the antidote, and afterwards purgatives and clysters. Vinegar and coffee, he states, promote the poisonous operation. Wine assists the patient's recovery.

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² *App. Méd.* vol. iv.

³ *Ibid.*

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⁶ *United States Dispensatory.*

⁷ Marx, *Die Lehre von d. Gift.* Bd. ii. S. 202.

grain of opium with five or eight of camphor. But in a great number of cases of fever, the cerebral disorder forbids the use of opium. From its specific influence over the cerebral functions, camphor has been frequently used in fever to allay the nervous symptoms—such as the delirium, the watchings, the subsultus tendinum, &c.; but it frequently fails to give relief. Dr. Home¹ did not find any advantage from its use in the low nervous fever; and Dr. Heberden² has seen one scruple of camphor given every six hours, without any perceptible effect in abating the convulsive catchings, or composing the patient to rest.

2. *In inflammatory diseases.*—In the latter stages of inflammation of internal important parts (as the serous and mucous membranes, the stomach, intestines, uterus, &c.), after proper evacuations had been made in the earlier periods of the disease, when great exhaustion is manifested by a small feeble pulse and a cold flaccid skin, small but repeated doses of camphor have been employed to determine to the skin, and to promote diaphoresis. It is particularly serviceable in rheumatic inflammation, and especially when produced by metastasis.³

3. *In the exanthemata.*—Camphor has been employed in smallpox, as also in measles, scarlatina, and miliary fever: but it is admissible only when the circulation flags, and the temperature of the surface falls below the natural standard. In such cases it is sometimes employed along with a diaphoretic regimen to determine to the skin. It is to be carefully avoided when inflammation of the brain or its membranes is feared. It has been asserted that if a camphorated ointment be applied to the face, no smallpox pustules will make their appearance there; but the statement is not correct.

4. *In mania, melancholia, and other forms of mental disorder.*—Camphor is occasionally taken to cause exhilaration. I am acquainted with two persons (females), both of nervous temperament, who use it for this purpose. To relieve despondency I have often found it serviceable. In mania and melancholia, it has now and then proved serviceable by its narcotic effects: it induces mental quiet, and causes sleep. It was used in these affections by Paracelsus and several succeeding writers,⁴ especially, in more modern times, by Dr. Kinneir,⁵ and by Avenbrugger.⁶ The latter regards it as a specific in the mania of men, when accompanied with a small contracted penis, corrugated empty scrotum, or when both testicles are so retracted that they appear to be introduced into the abdominal cavity.

5. *In spasmodic affections.*—The narcotic influence of camphor has occasionally proved serviceable in some spasmodic or convulsive affections; viz., spasmodic cough, epilepsy, puerperal convulsions, hysteria, and even tetanus: its use, however, requires caution.

6. *In irritation of the urinary or sexual organs.*—A power of diminishing irritation of the urinary organs has long been assigned to camphor. In strangury and dysury, especially when produced by cantharides, it is said to have been used with benefit—a statement apparently inconsistent with that more recently made of its producing irritation of the urinary organs. In satyriasis, nymphomania, and onanism, it is said to have proved advantageous by its anaphrodisiac properties. In dysmenorrhœa, it sometimes proves serviceable as an anodyne.

7. *In poisoning.*—Small doses of camphor (administered by the mouth or by the rectum) have been exhibited with apparent benefit in cases of poisoning by opium.⁷ It has also been employed to mitigate the effects of cantharides, squills, and mezereon;⁸ but toxicologists, for the most part, do not admit its efficacy: at any rate, further evidence is required to establish it. Nor does there appear any valid testimony for believing that camphor possesses the power of checking mercurial salivation, as some have supposed.

8. *In chronic rheumatism and gout.*—A mixture of camphor and opium, in the

¹ Clin. Hist. p. 36.

² Sundelin, *Handb. d. spec. Heilmittell.* Bd. ii. S. 145.

³ Phil. Trans. vol. xxxv.

⁴ *Experim. de remed. specif. in mania virorum*, Vind. 1776.

⁵ Hahnemann, and Van Bavegem, in Marx's *Die Lehre v. d. Giften*, Bd. ii. S. 202 and 353.

⁶ Comment. art. Febris.

⁷ Murray, *App. Med.* vol. iv. p. 499.

⁸ Orfila, *Toxicol. Gén.*

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⁷ Marx, *Die Lehre von d. Gift.* Bd. ii. S. 202.

are light, odorous, not fibrous, but spongy or corky. The epidermis is brownish-gray: the cortical layers and inner surface reddish cinnamon brown, or almost rust-red, becoming darker by age. Sometimes small, white, micaceous crystals (like those found on *sassafras nuts*) are observed on the inner surface of the bark. *Sassafras wood* (*lignum radices sassafras vel lignum sassafras*) occurs in the form of large stems or branches, frequently more or less covered with the bark. The wood is soft or spongy, light, of a grayish-reddish tint, and has a fragrant aromatic odour. It is usually sold cut up into chips: *sassafras chips*.

BRAZILIAN SASSAFRAS; *Pão Sassafras*.—This is the produce of *Nectandra cymbarum* of Nees, the *Ocotea amara* of Martius. It grows in Rio Negro. Its bark is bitter and aromatic, and is used as a tonic and carminative.

SASSAFRAS NUTS; *Pichurim Beans*: *Faba Pichurim*.—These seeds (or rather cotyledons) are the produce of *Nectandra Pichury major* of Nees, and *Nect. Pichury minor* of Nees, trees growing in the province of Rio Negro. "They were imported from Brazil into Stockholm in the middle of the last century, and were found a valuable tonic and astringent medicine: during the continental war they were used as a bad substitute for nutmegs." They are still to be found in some of the old drug-houses of London. By keeping in a bottle, small micaceous crystals form on their surface. These seeds have been analyzed by Bonastre.¹ Their aromatic qualities depend on a volatile oil.

COMPOSITION.—Neither the bark nor the wood have been analyzed. They contain *volatile oil, resin, and extractive matter*.

PHYSIOLOGICAL EFFECTS.—The wood and the bark are stimulant and sudorific. Taken in the form of infusion, and assisted by warm clothing and tepid drinks, they excite the vascular system and prove sudorific. They owe their activity to the volatile oil, which possesses acrid properties.

USES.—Sassafras is employed as a sudorific and alterative in cutaneous, rheumatic, and venereal diseases. On account of its stimulant properties it is inadmissible in febrile or inflammatory conditions of the system. It is rarely or never used alone, but generally in combination with sarsaparilla and guaiacum.

ADMINISTRATION.—Sassafras is administered in the form of *oil or infusion*. The dose of the oil is from two to ten drops. *Sassafras tea*, flavoured with milk and sugar, is sold at daybreak in the streets of London, under the name of *saloop*. Sassafras is a constituent of the *Decoctum Sarzæ Compositum*; but the volatile oil is dissipated by boiling (see *ante*, p. 279).

OLEUM SASSAFRAS, [U. S.]; *Volatile Oil of Sassafras officinale, E.*; *Oil of Sassafras*.—(Obtained by submitting the wood to distillation with water.)—It is colourless, but, by keeping, becomes yellow or red. Its smell is that of sassafras; its taste hot. Sp. gr. 1.094. Water separates it into two oils; one lighter, the other heavier than water. By keeping, it deposits large crystals (stéaroptène; *sassafröl*, $C^{10}H^5O^2$), which are readily soluble. Oil of sassafras is rendered orange-red by nitric acid. It is said to be adulterated with oil of lavender or oil of turpentine;² but the statement, I suspect, does not apply to the oil found in English commerce. Oil of sassafras is stimulant and diaphoretic. It may be employed in chronic rheumatism, cutaneous diseases, and venereal maladies. It is a constituent of the *Compound Extract of Sarsaparilla* (see *ante*, p. 281).

144. LAURUS NOBILIS, Linn.—THE SWEET BAY.

Sez. Syst. Enneandria, Monogynia.

(Fructus, L.)

HISTORY.—The "green bay-tree" is mentioned, though erroneously in our translation of the Bible;³ the Hebrew word, translated *bay*, meaning *native*.⁴ Hippocrates⁵ used both the leaves and berries of the bay-tree (ἐάφνη) in medicine. Bay-leaf is analogous to the *malabathrum* of the ancients.⁶

¹ Journ. de Pharm. vol. xi. p. 1, 1825.

² Psalms, xxvii. 35, 36.

³ Opera, pp. 267, 623, 621, &c. ed. Fœs.

⁴ Bonastre. Journ. de Pharm. vol. xiv. p. 645, 1826.

⁵ Carpenter's Script. Nat. Hist.

⁶ Royle, Hindoo Med. pp. 32 and 56.

BOTANY. Gen. Char.—*Flowers* diœcious or hermaphrodite, involucreted. *Calyx* 4-parted; segments equal, deciduous. *Fertile stamens* 12, in 3 rows; the outer alternate with the segments of the calyx; all with 2 glands in the middle or above it. *Anthers oblong*, 2-celled, all looking inwards. *Female flowers*, with 2 to 4 castrated males, surrounding the ovary. *Stigma* capitate. *Fruit* succulent, seated in the irregular base of the calyx.—*Umbels* axillary stalked. *Leaf-buds* with valvate papery scales. *Leaves* evergreen (Lindley).

Sp. Char.—The only species.

A bush or small tree. *Bark* aromatic, rather bitter. *Leaves* alternate, lanceolate, acute, or acuminate, wavy at the edge, somewhat coriaceous. *Flowers* yellowish. *Fruit* (called by Nees a 1-seeded flesh berry, by De Candolle, a drupe) bluish-black, oval, size of a small cherry. *Seed* pendulous; *funiculus* compressed, ascending from the base of the fruit, and attached at the top of the testa; *testa* papery; *tunica interna* very thin; *embryo* exalbuminous, composed of two large oleaginous *cotyledons* inclosing superiorly the *radicle*.

Hab.—South of Europe. Cultivated in gardens.

DESCRIPTION.—Bay leaves (*folia lauri*) have a bitter aromatic taste, and a somewhat aromatic odour. Their infusion reddens litmus. Dried bay berries (*baccæ lauri*, offic.) are covered externally by a dark-brown brittle coat, which is produced by the epidermis and succulent covering of the fruit.

COMPOSITION.—In 1824, bay berries were analyzed by Bonastre,¹ who found the constituents to be—*Volatile oil* 0.8, *laurin* 1.0, *fixed oil* 12.8, *wax* (stearin) 7.1, *resin* 1.6, *un-crystallizable sugar* 0.4, *gummy extractive* 17.2, *bassorin* 6.4, *starch* 25.9, *woody fibre* 18.8, *soluble albumen* traces, *an acid* 0.1, *water* 6.4, *salts* 1.5.—The ashes (amounting to 1.2) consisted of carbonate of potash and the carbonate and phosphate of lime.

1. **VOLATILE OIL OF LAUREL BERRIES; Oil of Sweet Bay.**—Obtained from the berries by distillation with water. The crude oil is pale yellow, transparent, readily soluble in alcohol and ether. By redistillation it yields two isomeric oils ($C^{20}H^{16}O$); one having a sp. gr. of 0.857, the other 0.885, while a brown balsamic matter remains in the retort.²

2. **LAURIN; Camphor of the Bay berry.**—A crystalline solid, fusible and volatile. Has an acrid bitter taste, and an odour analogous to that of the volatile oil. It is soluble in ether and in boiling alcohol. Sulphuric acid renders it yellow; nitric acid liquefies it. Alkalies are without action on it. It is extracted from bay berries by rectified alcohol.

3. **FIXED OIL OF BAYS** (see below).

PHYSIOLOGICAL EFFECTS.—The berries, leaves, and oil are said to possess aromatic, stimulant, and narcotic properties. The leaves, in large doses, prove emetic.³

USES.—Bay berries or leaves are rarely, if ever, used in medicine in this country. They might, therefore, with great propriety be expunged from the Pharmacopœia. The leaves are employed by the cook on account of their flavour. Both leaves and berries have been used to strengthen the stomach, to expel flatus, and to promote the catamenial discharge.

ADMINISTRATION.—Both berries and leaves are used in the form of infusion.

OLEUM LAURI; Oleum Lauri expressum; Oleum Laurinum; Laurel Fat; Oil of Bays.—This may be obtained from either the fresh or dried berries. Duhamel⁴ states that it is obtained from the fresh and ripe berries by bruising them in a mortar, boiling them for three hours in water, and then pressing them in a sack. The expressed oil is mixed with the decoction, on which, when cold, the butyraceous oil is found floating. From the dried berries it is procured by exposing them to the vapour of water until they are thoroughly soaked, and then rapidly subjecting them to the press between heated metallic plates. By the latter method they yield one-fifth of their weight of oil.⁵ Oil of bays is imported in barrels from Trieste.

¹ Journ. de Pharm. x. 30.

² Brandes, Pharmaceutisches Central-Blatt für 1840, S. 344.

³ Merat and De Lens, Dict. Univ. de Mat. Méd. t. iv. p. 62.

⁴ Traité des Arbres et Arbustes qui se cultivent en France en pleine Terre, t. i. p. 351.

⁵ Soubeiran, Nouveau Traité de Pharmacie, t. ii. p. 32, 2de éd.

In 1839, duty was paid on 1737 lbs. of it. It has a butyraceous consistence and a granular appearance. Its colour is greenish; its odour is that of the berries. It is partially soluble in alcohol, completely so in ether. With alkalis it forms soaps. It is occasionally employed externally as a stimulating liniment in sprains and bruises, and in paralysis. It has also been used to relieve colic, and against deafness.¹ Its principal use, however, is in veterinary medicine.

OLEUM LAURI ÆTHEREUM NATIVUM; *Native Oil of Laurel*, Hancock, Trans. of the Medico-Bot. Society of Lond., p. 18, 1826; *Laurel Turpentine*, Stenhouse, Mem. of the Chemical Society, vol. i. p. 45, 1843.—Imported from Demerara: obtained by incision in the bark of a large tree, called by the Spaniards "*Azeyte de Sassafras*," growing in the vast forests between the Orinoco and the Parime. By Dr. Hancock this tree was thought to belong to the nat. ord. Lauraceæ; but Dr. Stenhouse thinks that it is a species of pine. The oil is transparent, slightly yellow, and smells like turpentine, but more agreeable, and approaching to the oil of lemons. Its sp. gr. at 56° F. is 0.8645. The commercial oil consists of two or more oils isomeric with each other and with oil of turpentine, C₂₀H₁₆. Its yellow colour is due to a little resin. A volatile acid (formic acid?) is also present in very small quantity. In its medicinal qualities it resembles turpentine; being stimulant, diuretic, and diaphoretic. It has been used externally as a discutient in rheumatism, swellings of the joints, cold tumours, paralytic disorders, &c. It is an excellent solvent for caoutchouc.

145. NECTANDRA RODIÆI, Schomburgk.—THE BIBIRU OR GREENHEART TREE.

Sex. Syst. Dodecandria, Monogynia.
(Cortex.)

HISTORY.—In 1769, Bancroft² noticed the valuable qualities of the wood of this tree, which he called the *Greenheart* or *Sipeira*. In 1834, Dr. Roder³ discovered that the bark was a good substitute for cinchona, and that both it and the fruit contained an alkaloid, which he used with great success in intermittents: he terms the tree the *Bebeeru*, and the alkaloid *Bebeerine*. In 1843,⁴ Dr. Douglas MacLagan published an account of the chemical and therapeutical properties of the bark, and confirmed the discoveries of Dr. Roder. The following year a full botanical description of the tree, which he terms *Bibiru*, or *Sipiri*, was drawn up by Sir Robert Schomburgk, aided by Mr. Bentham.⁵

BOTANY. Gen. Char.—*Flowers* hermaphrodite. *Calyx* 6-parted, rotate; segments deciduous, the 3 outer rather the broadest. *Stamens* 12, in 4 series; the 9 outer fertile, the 3 inner sterile; glands in pairs, globose, sessile, at the base of the 3 inner fertile stamens; the anthers in the first and second series turned inwards, those of the third series turned outwards, all ovate, nearly sessile with 4 cells arranged in a curve, and distinct from the tip of the anther, with as many ascending dehiscing valves; sterile stamens either tooth-shaped and biglandular at the base, or glandless, and then with a small ovule head. *Ovary* 1-celled, with 1 ovule in each cell. *Style* very short; *stigma* short and truncated. *Berry* 1-seeded, more or less immersed in the tube of the calyx changed into a truncated cup.—*Trees* of tropical America, with alternate, feather-veined leaves, and paniced or corymbose, axillary, lax, ample flowers (Endlicher).

Sp. Char.—*Leaves* nearly opposite, oblong-elliptical, shortly acuminate, coriaceous, smooth, shining, and obscurely netted on the upper side; *panicles* few-flowered,

¹ Murray, *Apparatus Medicam.* vol. iv. p. 533.

² *Natural History of Guiana*, 1769.

³ See the circular issued by Dr. Roder, and dated November 22, 1834; also, Sir Andrew Halliday's notice of Dr. Roder's discoveries, in the *Edinb. Med. and Surg. Journal*, vol. xlv. Oct. 1835.

⁴ *Transactions of the Royal Society of Edinburgh*, vol. xv. p. 423, 1843.

⁵ Hooker's *London Journal of Botany*, December, 1844, p. 624.

axillary, much shorter than the leaves, finely downy; *anthers* all thick oblong, without glands (Bentham).

A large forest tree, of 60 or more feet high, with a trunk frequently above 50 feet high, undivided by branches till near the top, and covered by an ash-gray smooth bark. *Leaves* 5 or 6 inches long, and 2 or 3 inches broad. *Flowers* yellowish-white. *Berry* somewhat obovate, globular, slightly compressed, the longer extension $7\frac{1}{2}$ inches in circumference, the less about $6\frac{1}{4}$ inches: the pericarp grayish-brown, speckled with whitish dots, hard, very brittle, and about a line thick. *Seed* 1 in each fruit, about the size and shape of a walnut, and containing 2 large plano-convex cotyledons.

HAB—British Guiana: on rocky hill-sides on the borders of rivers (the Essequibo, Cuyuni, Demerara, Pomeroon, Berbice, &c.).—The timber is used for ship-building, under the name of *Greenheart*.

DESCRIPTION.—*Bibiru* or *bebeeru bark* (*cortex bibiru*), is derived from the trunk. It consists of large, flat, heavy pieces, from 1 to 2 feet long, from 2 to 6 inches broad, and about 3 or 4 lines thick. It is covered externally with a brittle grayish-brown epidermis. Internally, its colour is dark cinnamon-brown. The fracture is rough and somewhat fibrous. The taste is strong, persistent, bitter, with considerable astringency, but with aroma, pungency, or acidity.

The fruit (*fructus bibiru*) commonly called a nut, has been described above. The seeds (*semina bibiru*) yield starch, which is used as food by the Indians. A section of the cotyledons, when moist and fresh, was pale yellow, and became brown by exposure to the air. The juice had an acid reaction, and was intensely bitter.

COMPOSITION.—The bark and seeds have been analyzed by Dr. MacLagan, and his results are as follows :—

	Bark.	Seeds (much dried by keeping).
Alkalies [bibirina and sipirina] (not quite pure) . . .	2.56	2.20
Tannin and resinous matter	2.53	4.04
Soluble matter (gum, sugar, and salts)	4.34	9.40
Starch	—	53.51
Fibre and vegetable albumen	62.92	11.24
Ashes (chiefly calcareous)	7.13	0.31
Water	14.07	18.13
Loss	6.45	1.17
Total	100.00	100.00

1. **BIBIRINA**; *Beebeerina*; *Biberine*; *Bebeerine*, $C^{35}H^{20}NO^6$.—Obtained by decomposing commercial sulphate of bibirina by ammonia; the precipitate is washed with cold water, triturated while still moist with moist hydrated oxide of lead, and the magma dried on a water-bath, and exhausted by rectified spirit. In this way is obtained an alcoholic solution of bibirina and sipirina, while the oxide of lead, tannin, and other impurities are left behind. The alcohol is to be distilled off, and the resinous-looking residue treated with pure ether, which dissolves the bibirina, but leaves behind the sipirina.

Bibirina is uncrystallizable. When obtained by evaporation from its ethereal solution, it is a yellow, amorphous, resinous-looking substance; but in the form of powder it is white. It is very soluble in alcohol, less so in ether, and very sparingly in water. Its alcoholic solution reacts as an alkali on reddened litmus paper. It dissolves in acids, and neutralizes them, forming amorphous yellow salts. Colourless or crystallized salts have not yet been procured. According to MacLagan and Tilley,¹ its composition is identical with morphia. Winckler² says, that bibirina resembles in many respects paracine, but differs from the latter in the circumstance of its hydrate being gelatinous.

2. **SIPIRINA**; *Sipeerina*; *Sipirine*; *Sipeerine*.—This substance, which Dr. MacLagan at first thought to be a second alkaloid, he now regards as a product of the oxidation of biberine.

3. **BIBIRIC ACID**; *Bebeeric Acid*.—A white, crystalline, deliquescent, volatile acid obtained from the seeds.

4. **STARCH**.—I am indebted to Dr. MacLagan for some of the starch obtained from the seeds of this plant. It is grayish-white, and almost tasteless. When examined by the microscope, it is found to consist of particles which are somewhat smaller than those of cassava starch, but in their external form quite agree with the latter. Schomburgk states that the Indians are

¹ *Pharmaceutical Journal*, vol. v. p. 228, 1845.

² *Ibid.* vol. vi. p. 493, 1847; also, *Buchner's Report*. 2ter Reihe, Bd. xlv. p. 231, 1846.

obliged to live for months on it. It is prepared by grating the seeds and immersing them in water. Repeated washing he found did not deprive the starch of its bitterness. The starch mixed with decayed wood, chiefly of the Walaba tree (*Eperna falcata*), is baked into cakes. Winckler has discovered starch in the bark as well as in the seeds.

5. **TANNIN.**—This agrees very much with that found in the cinchona bark; and, like the latter, it yields a green colour with the salts of iron.

PHYSIOLOGICAL EFFECTS.—Bibiru bark appears to possess the tonic, antiperiodic, febrifuge, and astringent properties of cinchona barks. Like the latter, its bitter, tonic, and antiperiodic powers reside in a vegetable alkaloid; and its astringent property in that kind of tannic acid which strikes a green colour with the salts of iron.

Sufficient experience has not yet been obtained with bibiru bark and its alkaloid (*bibirine*), to enable us to form an accurate opinion of their therapeutical power in comparison with cinchona bark and quinia. In some cases, bibirina has appeared to produce its peptic and tonic effects with less tendency to cause headache, giddiness, ringing in the ears, and feverishness, than quinia; and it can in consequence be administered to some patients with whom quinia disagrees. On the other hand, it appears inferior to the latter in febrifuge and antiperiodic power.

USES.—Bibiru bark and bibirina (in the form of sulphate) have been used as a peptic in anorexia and dyspepsia; as a general tonic in debility, protracted phthisis, and strumous affections; as a febrifuge in intermittent and remittent diseases; and as an antiperiodic in periodical headache and intermittent neuralgias.¹

BIBIRINÆ SUBSULPHAS; Bebeerinæ Sulphas; Sub-sulphate of Bibirine; Sulphate of Bebeerine.—The process for obtaining this is essentially the same as that of the Edinburgh Pharmacopœia for sulphate of quinia. The bark is first boiled with a solution of carbonate of soda to remove the tannin and colouring matter; it is boiled with water acidulated with sulphuric acid, by which sulphate of bibirine is obtained in solution. To the strained liquor carbonate of soda is added, and the impure bases thus thrown down washed, dissolved, and neutralized with sulphuric acid, and the solution decolorized by animal charcoal, concentrated, filtered, and finally evaporated in flat open vessels; excess of acid being avoided in order to prevent charring on evaporation.

There are two compounds of sulphuric acid and bibirina—the sulphate (BiSO_3) and the sub-sulphate (Bi^2SO_3): the latter is the commercial salt which has been prepared for medicinal use by Mr. Macfarlane, of Edinburgh:—

MacLagan (Trans. Royal Soc. Edinb.)		Macfarlane's basic commercial sulphate.	
Bibirina	86.39	. . . . .	90.83
Sulphuric acid	13.61	. . . . .	9.17
Neutral sulphate of bibirina . . .	100.00	Sub-sulphate of bibirina . .	100.00

The sub-sulphate of bibirina (Macfarlane's basic commercial sulphate of bebeerine) is not absolutely pure. It contains sub-sulphate of sipirina, sulphate of lime, and colouring matter. It occurs in brownish-yellow, thin, glittering scales, which form a yellow powder, and by incineration leave a mere trace of ash only. It has a very persistent bitter taste. It is soluble in alcohol. It is slightly soluble in cold water, with which it yields a turbid solution, partly from the excess of base, partly from the decomposing tendency of the sipirina. Its solution in water is rendered more complete by a few drops of sulphuric acid.

Its effects and uses have already been alluded to.

It may be administered in doses of from one to three grains as a tonic, and from

¹ For farther information respecting the therapeutical value of bibiru bark and bibirina, the reader is referred to Dr. MacLagan's papers on this subject, in the *Trans. of the Royal Society of Edinburgh*, vol. xv. 1843; *Cormack's Lond. and Edinb. Monthly Journal of Medical Science*, for August 1843; and the *Edinb. Med. and Surg. Journal*, No. 163. In these papers will be found the observations not only of Dr. MacLagan, but also of Drs. Rodie and Watt, of Demerara, Drs. Bennett and Simpson of Edinburgh, and of several army medical officers serving in the East Indies.

five to twenty grains as a febrifuge. In substance, it is given in the form of pill made with conserve of roses; and in solution, with dilute sulphuric acid. The following is given as a convenient form for its exhibition as a tonic: Sub-sulphate of bibirine 3ss; diluted sulphuric acid ℥xxv; syrup 3j; tincture of orange-peel 3j; water 3iv. Dose, one tablespoonful three times a day.

It has been recommended as an economical substitute for quinia; its price being about 6s. per oz.; while disulphate of quinia has been lately more than double that price.

ORDER XXXVI. MYRISTICACEÆ, *Lindley*.—NUTMEGS.

MYRISTICÆ, *R. Brown*.

CHARACTERS.—*Flowers* completely unisexual. *Calyx* trifid, rarely quadrifid; with vulvular aestivation. *Males*:—*Filaments* either separate, or completely united in a cylinder. *Anthers* 3 to 12, 2-celled, turned outwards, and bursting longitudinally; either connate or distinct. *Females*:—*Calyx* deciduous. *Ovary* superior, sessile, with a single erect ovule; *style* very short; *stigma* somewhat lobed. *Fruit* baccate, dehiscient, 2-valved. *Seed* nut-like; *albumen* ruminat. between fatty and fleshy; *embryo* small; *cotyledons* foliaceous; *radicle* inferior; *plumule* conspicuous.—*Tropical trees*, often yielding a red juice. *Leaves* alternate, without stipules, not dotted, quite entire, stalked, coriaceous; usually, when full grown, covered beneath with a close down. *Inflorescence* axillary or terminal, in racemes, glomerules, or panicles; the *flowers* often each with one short cucullate bract. *Calyx* coriaceous, mostly downy outside, with the hairs sometimes stellate, smooth in the inside (*Lindley*, from *R. Brown*, chiefly).

PROPERTIES.—The bark and pericarp contain an acrid juice. The seed (?) and arilloid abound in an aromatic volatile oil, which is mixed with a fixed oil.

146. MYRISTICA FRAGRANS, *Houtt.*—THE TRUE NUTMEG TREE.

Sex. Syst. Diœcia, Monadelphica.

(*Seenen* putamine nudatum; *oleum* esmine expressum, concretum *L.*—Kernel of the fruit; volatile oil from the kernel; concrete expressed oil from the kernel, *E.*—The kernel of the fruit, *D.*)

SYNONYMES.—*Myristica fragrans*, *Houttuyn*, *Nat. Hist.* (1774), vol. ii. part iii. p. 333; *Blume*, *Rumphia*, I. 180, 1835.—*M. officinalis*, *Linn.* (1781); *Hooker*, *Bot. Mag.* vol. i. N. S. tab. 2756 and 2757.—*M. moschata*, *Thunberg* (1782)—*M. aromatica*, *Lamarek* (1788).

HISTORY.—Both nutmegs and mace¹ were unknown to the ancient Greeks and Romans; unless, indeed, the nutmeg be the aromatic Arabian fruit used in unguents, and which *Theophrastus*² calls κόμαχον. *Pliny*³ says that the *cinnamum quod comacum appellant* is the expressed juice of a nut produced in Syria. Does he refer to the expressed oil of nutmeg, as some have suggested? Both mace and nutmegs are referred to by *Avicenna*.⁴

The modern Greek names for the nutmeg and mace are respectively *μοσχοκάρνα* and *μοσχομάχερ*.

BOTANY. **Gen. Char.**—*Anthers* united throughout their whole length into a cylindrical column. *Stigma* emarginate, somewhat 2-lobed. *Cotyledons* folded (*Blume*).

Sp. Char.—*Leaves* oblong, subacute at the base, smooth. *Peduncles* axillary, few-flowered. *Calyx* urceolate. *Fruit* nodding, obovoid, globose, smooth (*Blume*).

A tree from 20 to 25 feet high, similar in appearance to a pear tree. *Bark* dark grayish-green, smooth, with a yellowish juice. *Leaves* aromatic. *Racemes* axillary. *Peduncles* and *pedicels* glabrous, the latter with a quickly deciduous ovate bract at its summit, often pressed close to the flower. *Flowers* usually diœcious, sometimes monœcious. *Males*:—3 to 5 on a peduncle; *calyx* fleshy, pale yellow,

¹ The κόμας of *Dioscorides* (lib. i. cap. 110, the *maceir* of *Pliny* (lib. xii. cap. 16), was an astringent bark, and not, as some have supposed, our mace.

² *Hist. Plant.* lib. ix. cap. 7. *Frans* (*Syn. Plant. Fl. classicæ*, p. 135, 1835) considers κόμαχον to be our nutmeg.

³ *Hist. Nat.* lib. xii. cap. 63, ed. *Vulp.*

⁴ Lib. ii. tract. ii. cap. 436 and 503.

with a reddish pubescence. *Females*:—scarcely different from the males, except that the pedicel is frequently solitary. *Fruit* pyriform, smooth externally, about the size of a peach, marked by a longitudinal groove. *Pericarp* fleshy, dehiscing by two nearly equal longitudinal valves. *Arillode*¹ (false aril), commonly called *Mace*, large, fleshy, branching, scarlet; when dry, yellow, brittle, and somewhat horny. *Seed* (*nutmeg in the shell*, offic.) within the arilloid, oval or ovate; its outer coat (*testa*, *tunica externica*, or *shell*) is dark brown, hard, glossy; its inner coat (*endopleura* seu *tunica interna*) closely invests the seed, and dips down into the substance of the albumen, giving it a marbled or *ruminated* appearance. The *nucleus* or *nut* (the *round* or *true nutmeg* of the shops) consists chiefly of the oleaginous *albumen*; the so-called veins of which are processes of the endopleura, which have a reddish-brown colour, and abound in oil; the *embryo* is at the base of the seed; *radicle* inferior, hemispherical; *cotyledons* 2, large, flat, foliaceous, fan-shaped; *plumule* 2-lobed.

Hab.—Molucca Islands, especially the group called the Banda or Nutmeg Isles.² Cultivated in Java, Sumatra, Penang (Prince of Wales Island), Singapore, Bengal, Bourbon Islands, Madagascar, and some parts of the West Indies.

MYRISTICA FATUA, Houtt. Blume; *M. tomentosa*, Thunberg; *M. dutyloides*, Gærtn. (the synonyms excluded); *Nux moschata fructu oblongo*, C. Bauh.; *Nux myristica mas*, Clusius—A native of the Banda Isles.—Fruit elongated, ellipsoidal, rusty, tomentose. Seed elongated, ellipsoidal, covered by a membranaceous fleshy, orange coloured, insipid arilloid (mace); outer coat (*testa*) dark brown, hard; nucleus acerb, slightly aromatic, grayish ash-coloured, cylindrical, ellipsoidal, rugous, marked by a furrow.—Yields the *long nutmeg* of the shops.

Colonel Sykes³ says, that *M. doctyloides* is frequently imposed upon the ignorant for the real nutmeg.

Closely allied to this is the *M. MALABARICA*, Lam., or *Malabar Nutmeg*; it is the *Panam-pila* of Rheede (Hist. Malab. part iv. tab. 5). The latter authority says that the nucleus resembles the *date* in size and figure. Unlike the male or long nutmeg, it has scarcely any flavour or odour. Rheede adds, that “the Turkish and Jewish merchants mix these nutmegs with the true long ones, and the mace with good mace, selling them together. They also extract from these inferior articles an oil, with which they adulterate that of a more genuine quality.”⁴ The Malabar nutmeg, according to Rheede, differs from the long nutmegs in size, hardness, and especially in flavour.

CURING.—In the Banda Isles there are three harvests annually; namely, the principal one in July or August, the second in November, and the third in March or April. The ripe fruit is gathered by means of a barb attached to a long stick; the mace separated from the nut, and both separately cured.

Mace is prepared for the market by drying it for some days in the sun. Some flatten it by the hands in single layers; others cut off the heels, and dry the mace in double blades.⁵ In rainy weather, artificial heat is employed for drying it. At first, the mace is crimson or blood-red, but after a few months acquires the golden colour preferred by the dealers.⁶ The Dutch sprinkle the mace with salt water prior to packing it in the sacks called *sokkol*.⁶

¹ The lacinate envelope of the nutmeg, usually called the aril, and which constitutes the substance called *mace*, is said by M. Planchon to be nothing but an expansion of the exostome, and, therefore, an *arillode* or *false aril*.

² The Dutch endeavoured to confine the growth of the nutmeg to three of the Banda Isles; viz., Lantour or Banda proper, Banda-Neira, and Way (Pulo Ay); but their attempts were partly frustrated by a pigeon, called the *nutmeg bird* or *nut-eater* (a species of *Carpophaga*), which, extracting the nutmeg from its pulpy pericarp, digests the mace, but voids the nutmeg in its shell, which, falling in a suitable situation, readily germinates. Young plants thus obtained are used for transplanting into the *nutmeg parks*. During the time that the English had possession of the Molucca Islands (namely, from 1796 to 1802; and, again, from 1810 to 1814), they exported plants to Bencoolen in Sumatra, to Penang, India, and other places. In 1810, the nutmeg tree was sent from Bencoolen to Sumatra, where it is now largely cultivated. (For a sketch of the culture and trade in nutmegs, and of the monopolizing policy of the Dutch, the reader is referred to Crawford's *History of the Indian Archipelago*, vol. i. p. 505; vol. ii. p. 437; vol. iii. p. 406.) To keep up the price of this spice, the Dutch used to burn nutmegs when the crops were superabundant! (See Hooker's *Bot. Mag.* vol. i. N. S. i. 1927, t. 2756-2757; also Stephenson and Churchill's *Med. Bot.* vol. iii. pl. 104.)

³ *Madras Journal of Science*. No. 22, p. 161 (quoted by Graham in his *Catalogue of the Plants growing in Bombay and its Vicinity*, 1839).

⁴ Newbold, *Polit. and Statist. Account of the British Settlements in the Straits of Malacca*, vol. i. 1830.

⁵ Oxley, *Some Account of the Nutmeg and its Cultivation*, in the *Journal of the Indian Archipelago* and Eastern Asia, October 1843, p. 641, Singapore.

⁶ C. B. Valentini, *Indiæ Literata*, Epist. xxv., contained in M. B. Valentini's *Historia Simplicium reform.* 1716.

Nutmegs require more care in curing, on account of their liability to the attacks of an insect (the *nutmeg insect*). It is necessary to have them well and carefully dried in their shells, as in this state they are secure from the attack of this insect.¹ In order to effect this they are placed on hurdles or gratings, and smoke-dried for about two months by a slow wood-fire, at a heat not exceeding 140°F. (In the Banda Isles they are first sun-dried for a few days.) When thoroughly dried, the nuts rattle in the shells, which are then cracked with wooden mallets, and the worm-eaten and shrivelled nuts thrown out.

To prevent the attacks of the insect the nuts are frequently limed. For the English market, however, the brown or unlined nutmegs are preferred. The Dutch lime them by dipping them in a thick mixture of lime and water; but this process is considered to injure their flavour. Others lime them by rubbing them with recently prepared, well-sifted lime. This process is sometimes practised in London.

After being garbled, the nutmegs are packed for transportation in tight casks, the insides of which have been smoked and covered with a coating of fresh water and lime. Newbold says the unlimed nutmegs are mixed with cloves.

The dried produce of a nutmeg tree consists of nutmeg, mace, and shell, in the following proportions: In 15 parts of the whole produce there are 2 parts of mace, 5 of shell, and 8 of nutmegs. Hence, although nutmegs in the shell may keep better than the clean or shelled nutmegs, yet the heavy allowance required for the shell (viz. about one-third) is a serious objection to their preservation in this form.

DESCRIPTION. 1. *Of Nutmegs* (*Nuces moschatæ*).—In commerce, two kinds of nutmegs are met with; one called the *true* or *round*, the other the *long* or *wild*.

a. *True or Round Nutmeg*; the *female nutmeg*; *nux myristica fœmina*, Clusius; *nux moschata fructu rotundo*, C. Bauh.—This sort is the produce of *Myristica fragrans*. It is about an inch in length. Its shape is roundish or elliptical, like that of the French olive. Externally, it is marked with reticular furrows. The colour of the *unlimed* or *brown* nutmegs is ashy brown; that of *limed* nutmegs is brown on the projecting parts, and white (from the presence of lime) in the depressions. Internally, nutmegs are pale reddish-gray, with red veins. The odour is strong, but pleasant, peculiar, and aromatic. The taste is agreeable and aromatic.

Occasionally, the round nutmeg is imported *in the shell*. This is dark and shiny.

A very small nutmeg, not larger than a pea, has been described under the name of the *royal nutmeg* (*nux moschata regia*).

In the London Market, the following are the sorts of round nutmegs distinguished by the dealers:—

1. *Penang nutmegs*.—These are unlimed or brown nutmegs, and fetch the highest price. They are sometimes limed here for exportation, as on the continent the limed sort is preferred. According to Newbold, the average amount annually raised at Penang is 400 piculs (of 133½ lbs. each).

2. *Dutch or Batavian nutmegs*.—These are limed nutmegs. In London, they scarcely fetch so high a price as the Penang sort.

3. *Singapore nutmegs*.—These are a rougher, unlimed, narrow sort, of somewhat less value than the Dutch kind. According to Mr. Oxley, 4,085,361 nutmegs were produced at Singapore, in 1848, or about 252 piculs (of 133½ lbs. each); but the greater number of the trees had not come into full bearing, and it was estimated that the amount would, in 1849, be 500 piculs.

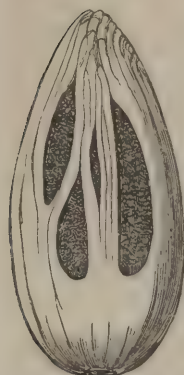
Fig. 299.



True or Round Nutmeg
surrounded by its mace.
(From a specimen preserved wet.)

¹ Crawford, *Hist. of the Ind. Archip.*

Fig. 300.



Long or Wild Nutmeg,
surrounded by its mace.
(From a dry commercial
specimen.)

β. *Long or Wild Nutmegs*;¹ the *male nutmeg*; *nux myristica mas*, Clusius; *nux moschata fructu oblongo*, C. Bauhin.—This is the produce of *Myristica fatua*. It is met with in commerce in three forms: in the shelled or clean state (*long or wild nutmegs*), contained within the shell (*long or wild nutmegs in the shell*), and with mace dried around them (*long or wild nutmegs covered with mace*).

The long or wild nutmeg in the shell in shape is oblong, like that of the date; its length about an inch and a half. The shell is bony, somewhat brittle, externally shiny and brown, internally dull, grayish-white. The contained seed is paler coloured and less aromatic than in the preceding sort. Some specimens are almost insipid. Are these the *Malabar wild nutmegs* before referred to (see *ante*, p. 412)? The mace which is sometimes found in the long nutmeg is insipid.

2. **Of Mace** (*Macis*).—Two kinds of mace are found in commerce; one called *true* or *genuine*, the other *wild* or *false*.

a. *True or genuine mace*.—This is the produce of the round or true nutmeg. It occurs in single or double blades, flat, irregularly slit, smooth, slightly flexible or brittle membrane, of a pale cinnamon-yellow or golden-yellow colour, and an

odour and taste analogous to those of nutmegs. Although the natural colour of mace is red, yet red-coloured mace is looked on suspiciously.

The London dealers distinguish three sorts of genuine mace:—

1. *Penang mace*.—This fetches the highest price. It is flaky and spread. The annual quantity produced in Penang is about 130 piculs (of 133½ lbs. each).

2. *Dutch or Batavian mace*.—This is a fleshy sort; it scarcely fetches so high a price as the Penang sort.

3. *Singapore mace*.—This is a somewhat inferior kind.

β. *Wild or false mace*.—This is a dark red mace, the produce of the long or wild nutmeg, and is also devoid of aromatic flavour.

COMPOSITION.—Nutmegs were analyzed in 1823 by Bonastre.² In 1824, an analysis of mace was made by N. E. Henry.³

NUTMEG.	
Bonastre's Analysis.	
Volatile oil	6.0
Liquid fat	7.6
Solid fat	24.0
Acid (?)	0.8
Starch	2.4
Gum	1.2
Ligneous fibre	54.0
Loss	4.0
Nutmeg	100.0

MACE.	
N. E. Henry's Analysis.	
Volatile oil.	
Red fat oil soluble in alcohol.	
Yellow fat oil insoluble in alcohol.	
Alcoholic extractive.	
Amidin.	
Ligneous fibre with lime.	

Mace.

The volatile oils and the fats will be noticed hereafter, as they are employed in medicine. The starch occurs in small compound grains.

CHEMICAL CHARACTERISTICS.—The presence of starch in both nutmegs and mace may be detected by a solution of iodine, which gives them a blue tint (*iodide of starch*). Both of these substances yield, by distillation with water, a *volatile oil*, characterized by its peculiar odour; and both yield, by expression, a *fixed butyraceous oil*.

PHYSIOLOGICAL EFFECTS.—The activity of both nutmegs and mace depends on the volatile oil which they contain. Swallowed in moderate quantities, they produce the before-described effects of the spices (see vol. i. p. 250). In large doses

¹ Sir J. E. Smith (Rees's *Cyclopædia*) says that in 1797 they were received from Banda under the name of *New Guinea nutmegs*. A specimen of the fruit and leaves, preserved in spirit in the Banksian collection, is marked the *long nutmeg from Sumatra*.

² *Journ. de Pharm.* t. ix. p. 281, 1823.

³ *Ibid.* t. x. p. 181, 1824.

they prove narcotic, and cause giddiness, delirium, præcordial anxiety, sleepiness, or actual stupor. Instances of this kind are mentioned by Bontius,¹ Rumphius,² Lobel,³ Schmid,⁴ and Cullen.⁵ In the case related by the last-mentioned authority, two drachms of powdered nutmegs produced drowsiness, which gradually increased to complete stupor and insensibility. The patient continued for several hours alternately delirious and sleeping, but ultimately recovered. Purkinje⁶ has confirmed these statements by experiments made on himself. I am acquainted with a case in which the narcotic effects of a whole nutmeg have been several times experienced.

USES.—The principal consumption of nutmegs and mace is for dietetical purposes. They serve to flavour, and, by their stimulant properties, to assist the digestive process. Food highly seasoned with substances may prove these injurious in cerebral affections (apoplexy, for example), on account of their narcotic properties.

Medicinally they are used, like other spices, as stimulants, carminatives, and flavouring ingredients. Nutmeg is an important constituent in the *confectio aromatica* (see p. 393) so frequently employed as a cordial and antacid in bowel complaints. In mild cases of diarrhoea, I frequently employ nutmeg as a substitute for opium. It may be taken in warm brandy and water, unless the use of spirit be contraindicated.

ADMINISTRATION.—Either nutmeg or mace may be taken to the extent of a scruple or half a drachm, in powder obtained by grating; or the volatile oil of these substances may be used in doses of \mathfrak{m}_j to \mathfrak{m}_v .

1. **OLEUM MYRISTICÆ, E. D. [U. S.]**; *Oleum Nucis Moschatæ*; *Oleum Nucistæ æthereum*; *Essential Oil of Nutmeg*; *Volatile Oil of Nutmeg*.—(Procured by submitting Nutmegs and Water to distillation.)—The usual produce of volatile oil in the distillations at Apothecaries' Hall, London, is 4.5 per cent.; but the oil is generally imported. It is colourless, or pale yellow, has the odour and taste of nutmegs, and a viscid consistence. By agitation with water it separates into two oils, one lighter, the other heavier than water. By keeping, it deposits crystals of stéaroptène (*myristicine*), which are fusible at 212° F., volatile, soluble in alcohol, in ether, and in boiling water; from the latter liquid myristicine separates in a crystalline form as the liquid cools. According to Mulder, the stéaroptène consists of $\text{C}^{10}\text{H}^{16}\text{O}^2$. Volatile oil of nutmegs is seldom employed medicinally. Its dose is \mathfrak{m}_j to \mathfrak{m}_v , taken on sugar, or dissolved in spirit.

2. **OLEUM MACIDIS**; *Essential Oil of Mace*.—This is colourless or pale yellow, lighter than water, and has the flavour and odour of mace. Its composition, effects, and uses are similar to those of nutmegs.

3. **MYRISTICÆ ADEPS, E.**; *Myristicæ Oleum, L.*; *Oleum vel Balsamum Nucistæ*; *Butter of Nutmegs*; *Expressed or Concrete Oil of Nutmegs*.—In the shops, it is usually denominated *expressed oil of mace*. It is prepared by beating the nutmegs to a paste (which is to be inclosed in a bag, and then exposed to the vapour of water), and afterwards expressing by heated plates. It is imported in oblong cakes (covered by some monocotyledonous leaves, commonly called *flag leaves*), which have the shape of common bricks, but whose size is somewhat smaller. Its colour is orange, its consistence firm, its odour fragrant, like that of the seeds from which it is obtained. In 1804, it was examined by Schrader,⁷ who found that 16 parts of concrete oil, expressed by himself, consisted of 1 part of volatile oil, 6 parts of brownish-yellow fat, and 9 parts of white fat. In 16 parts of the commercial concrete oil, he found $\frac{3}{4}$ volatile oil, $8\frac{1}{4}$ yellow fat, and 7 parts of white fat. The volatile oil and yellow fat are soluble in both cold alcohol and cold ether. The white fat (known by the name of *corpus pro balsamis*, or *mater balsamorum*), is

¹ *De Med. Indor.*

² Quoted by Murray, *App. Med.* vol. vi. p. 145.

³ *Mat. Med.* vol. ii. p. 204.

⁴ Quoted by Wilmner, *Die Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 393.

⁵ *Berlinisches Jahrbuch für d. Pharmaco.* 1804, p. 83.

⁶ *Herb. Amboyn.* vol. ii. p. 21.

⁷ *Ibid.*

soluble in boiling alcohol and boiling ether; but is insoluble in cold alcohol and ether. It has been more recently examined by Dr. L. Playfair,¹ who calls it *myristine* (formerly *sericine*). By saponification it yields glycerine and myristic acid ($C_{18}H_{37}O_3$, HO). Playfair mentions a false butter of nutmegs, composed of animal fat, boiled with powdered nutmegs, and flavoured with sassafras. The specimen may be relied on as pure, if it dissolve in four times its weight of strong boiling alcohol, or half that quantity of ether.

Expressed oil of nutmegs is occasionally employed externally in chronic rheumatism and palsy. It is a constituent of *Emplastrum Picis* (see *ante*, p. 302).

4. SPIRITUS MYRISTICÆ, L. E. [U. S.]; *Spirit of Nutmeg*.—(Nutmegs, bruised, ʒijss [ʒij. U. S.]; Proof Spirit [Diluted Alcohol, U. S.], Cong. j.; Water Oj. Mix them, then [with a slow fire, L.] let a gallon distil.)—It is frequently prepared by mixing volatile oil of nutmegs with proof spirit. It is cordial and carminative; and is employed in doses of fʒj to fʒiv, as a pleasant addition to stimulant, narcotic, or purgative draughts.

5. ESSENTIA MYRISTICÆ MOSCHATÆ, D.; *Essence of Nutmeg*.—(Volatile Oil of Nutmegs fʒj; Stronger Spirit fʒix. Mix with agitation, D.)—Used as a substitute for the Spirit of Nutmeg. Dose, a few drops on a lump of sugar.

ORDER XXXVII. THYMELACEÆ, Lindl.—DAPHNADS.

THYMELEÆ, Jussieu.—DAPHNOIDEÆ, Endl.

CHARACTERS.—*Calyx* inferior, tubular, coloured; the limb 4 cleft, seldom 5 cleft, with an imbricated æstivation. *Corolla* 0, or sometimes, scale-like petals in the orifice of the calyx. *Stamens* definite, inserted in the tube or its orifice; often 8, sometimes 4, less frequently, 2; when equal in number to the segments of the calyx, or fewer, opposite to them; *anthers* 2-celled, dehiscing lengthwise in the middle. *Ovary* composed of a single carpel, with 1 solitary pendulous anatropal ovule; *style* 1; *stigma* undivided. *Fruit* hard, dry, and nut-like, or drupaceous. *Albumen* 0, or thin and fleshy; *embryo* straight; *cotyledons* plano-convex, sometimes lobed and crumpled; *radicle* short, superior; *plumule* inconspicuous.—*Stem* shrubby, very seldom herbaceous, with tenacious bark. *Leaves* without stipules, alternate or opposite, entire. *Flowers* capitate or spiked, terminal or axillary, occasionally solitary, sometimes unisexual by abortion, often inclosed in an involucre (R. Brown, with some additions).

PROPERTIES.—The prevailing property of the plants of this order is acidity. This depends on a principle contained in the bark and pericarp. The liber of many species is remarkably tough, and is applied to various useful purposes; as for making ropes, whips, a kind of cloth, &c.—The *LAGETTA LINTEARIA* or the *Lace Bark Tree*, which possesses the medicinal properties of mezereon, and has been used in the same cases,² is provided with a bark, which may be separated into 20, 30, or more laminæ, which are fine and white like gauze; and of these, caps, ruffles, and even whole suits of ladies' clothes, have been made.³ Some few years since, a quantity of the stiffened lagetta cloth was imported into Liverpool under the name of *guana*.

147. DAPHNE MEZEREUM, Linn.—COMMON MEZEREON OR SPURGE-OLIVE.

Sex: Syst. Octandria, Monogynia.
(Radicis cortex, L.—Root-bark, E. D.)

HISTORY.—Tragus⁴ is the earliest author who mentions this plant.⁵ He calls it *Thymelæa*. The *Mezereon* of Avicenna,⁶ and of other Arabian authors, is declared by C. Bauhin to be *Chamelæa tricoeca* (now called *Cneorum tricoecon*), a plant of the order Euphorbiaceæ; but it is probably identical with the χαμελαία of Dioscorides, which is declared by Sibthorpe⁷ and Fraas⁸ to be *Daphne oleoides*.

¹ Lond. Ed. Dub. Phil. Mag. vol. xviii. p. 102, 1841; and Ann. de Chim. et de Phys. 3me sér. t. iii. p. 228, 1841.

² Wright's Med. Plants of Jamaica.

³ Hist. Stirpium. 1532.

⁴ Lib. 2ndus, tract. 2ndus, cap. 464.

⁵ Synops. Plant. Fl. Classicæ, 1845.

⁶ Sloane's Nat. Hist. of Jamaica. vol. ii. p. 22.

⁷ Sprengel. Hist. Rei Herb. Præf. xi.

⁸ Prod. Fl. Græcæ.

BOTANY. Gen. Char.—*Flowers* hermaphrodite. *Calyx* funnel-shaped; limb in 4 segments; throat without scales. *Stamina* 8, inclosed within the tube, inserted in 2 rows near the throat. *Hypogynous scales* 0. *Ovary* 1-celled. *Style* terminal, very short; *stigma* capitate. *Drupe* baccate, 1-seeded, naked, with a crustaceous putamen or stone. *Seed* inverted; *albumen* 0; *embryo* orthotropal; *cotyledons* plano-convex (Endlicher).

Sp. Char.—*Flowers* naked on the stem, sessile, about 3 together. *Leaves* lanceolate, deciduous (Smith).

Stem bushy, 4 or 5 feet high, with upright, alternate, smooth, tough, and pliant branches; leafy while young. *Leaves* scattered, stalked, lanceolate, smooth, 2 inches long, appearing after the flowers, and soon accompanied by flower-buds for the next season. *Flowers* highly, and to many persons too powerfully, fragrant, seated in little tufts on the naked branches, with several brown, smooth, ovate bracteas underneath. *Calyx* like a corolla in texture, crimson all over; the tube, externally hairy. *Berries* scarlet.

Hab.—Indigenous. Plentiful near Andover. Flowers in March. Collected for medicinal purposes in Kent and Hampshire.

Var. *flore albo* has white flowers and yellow fruit.

Var. *autumnale* has larger leaves and flowers in the autumn.

DESCRIPTION OF THE BARK.—The *root-bark* (*cortex radice mezerei*) is alone employed in this country. It is tough, pliable, and when dry fibrous; externally brown and corrugated; internally white, tough, and cottony. It occurs in strips of several inches long. When chewed, the taste is at first sweetish; afterwards an acrid burning sensation is felt in the mouth and fauces, and extends to the gullet and stomach if the bark and saliva be swallowed. This sensation continues for several hours. The odour of the fresh root is faint, but marked.

The *stem-bark* (*cortex caudicis vel caulis mezerei*) is usually considered to be somewhat less active than the root-bark; but in the Dublin, United States, and most of the continental Pharmacopœias, the bark of both root and stem is included under the general name of *mezereon bark* (*cortex mezerei*). The stem-bark, in the fresh state, is externally somewhat darker and rougher than the root-bark; but it is most readily recognized, in the fresh state, by the green colour of the cellular integument beneath the epidermis.

In Germany, the bark of the stem and larger branches is removed in spring, folded in small bundles, and dried for medicinal use. It is imported from Ham-burgh.

I am informed by Mr. McCulloch, of Covent Garden Market, that the root-bark commands nearly three times the price of the stem-bark. The bark is stripped from the crushed roots while fresh and soft.

Sometimes the entire root (bark and wood) of mezereum is used instead of the root-bark; but this proceeding is highly objectionable, as the wood possesses only a feeble acidity.

The bark of other species of *Daphne* (as of *D. Gnidium* and *D. Laureola*) is said to be sometimes substituted for that of the mezereon.

Mr. Squire¹ states that

13½ lbs. of fresh mezereon } 3¼ lbs. of wood.
 root produced by drying { 3½ lbs. of bark, dry; equivalent to 8½ lbs. of fresh bark.
 3 lbs. of stems produced ¼ lb. of dried bark.

COMPOSITION.—The bark of the stem was analyzed by C. G. Gmelin and Bär,² and found to consist of *resin*, an *acid resin*, *daphnin*, a trace of *volatile oil*, *yellow colouring principle*, *un-crystallizable but fermentable sugar*, *nitrogenous gummy matter*, *reddish brown extractive*, *woody fibre*, *free malic acid*, and *malates of potash, lime, and magnesia*.

¹ *Pharmaceutical Journal*, vol. i. p. 395, 1842.

² L. Gmelin, *Handb. d. Chem. Bd. ii. S. 1317.*

1. **ACRID RESIN.**—Obtained by boiling the bark in alcohol; when the solution cools, some wax is deposited. The supernatant liquid is to be evaporated, and the residual extract washed with water. The resin then left behind is dark green, and soluble in both alcohol and ether. To this substance mezereon owes its acidity. There is, however, some reason to suspect that this resin is itself a compound of two principles, viz. an acrid, vesicating, fixed oil, and another substance. The resin is rendered soluble in water by means of the other constituents of the bark. Mr. Squire could not obtain any blistering effect from the resin extracted by alcohol.

2. **DAPHNIN.**—A peculiar crystalline principle, having a bitter, slightly astringent taste. It is soluble in alcohol and ether, but possesses neither basic nor acid properties. Gmelin and Bar consider it to be analogous to asparagin. It is not the active principle of mezereon.

3. **ACRID VOLATILE OIL?**—According to Mr. Squire, mezereon contains a volatile acrid substance which is carried off by the vapour of water, but not by the vapour of alcohol. He says that “the pungent odour given off by boiling mezereon root in water over a lamp is so powerful, that, after holding my head over it for a short time, great irritation was produced, and it was difficult to carry on respiration.”

PHYSIOLOGICAL EFFECTS.—All parts of the plant, but more especially the bark and the fruit, are endowed with excessive acidity; in virtue of which they cause irritation and inflammation in tissues to which they are applied. When swallowed, therefore, in large quantities, they prove poisonous. The topical action of mezereon bark is that of an irritant, and, when the bark has been applied to the skin, vesicant.

A decoction of mezereon bark, taken in moderate quantities, sometimes appears to promote the action of the secreting and exhaling organs (especially the kidneys and the skin). But Dr. Alex. Russell¹ could not observe, upon the strictest inquiry, “that it sensibly increases any of the secretions, more than the same quantity of any small liquor would do.” In some cases it proves laxative, where the patients are easily moved, and large doses disturb and irritate the stomach. Richter² says that, under the long-continued use of mezereon, the saliva acquires a peculiar odour. In larger doses it causes dryness and heat in the throat, increased saliva, pain in the stomach and bowels, and sometimes vomiting and purging—the stools being occasionally bloody. The urinary organs are sometimes specifically affected by it; irritation, analogous to that produced by cantharides, being set up by it. An affection of the cerebro-spinal system (marked by great feebleness, giddiness, incapability of keeping the erect posture, and slight convulsive movements) is occasionally brought on.³ I am unacquainted with any cases which have proved fatal from the use of mezereon bark. Vicat⁴ mentions the case of a dropsical patient, in whom the wood caused diarrhoea, pain, and vomiting, which continued for six weeks.

USES.—In this country, mezereon is scarcely ever employed alone. It is usually administered in conjunction with sarsaparilla (see *ante*, p. 278), and is employed as a sudorific and alterative in venereal, rheumatic, scrofulous, and chronic cutaneous diseases. Decoction of the root-bark of mezereon was recommended to the notice of the profession, by Dr. Alexander Russell,⁵ as a very efficacious remedy in cases of venereal nodes and nocturnal pains. Dr. Home⁶ also speaks of it as “a powerful deobstruent in all venereal tumours of the scirrhus kind, where mercury has failed.” But Mr. Pearson,⁷ after many years’ observation of it, says, “I feel myself authorized to assert unequivocally, that the mezereum has not the power of curing the venereal disease in any one stage, or in any one form.” Dr. Cullen⁸ employed it with success in some cutaneous diseases.

As a topical remedy, it is sometimes applied to relieve toothache. It is occasionally used as a *masticatory*. Dr. Withering⁹ cured a case of difficulty of swallowing (arising from a paralytic affection) by mezereon, which he directed to be chewed frequently. In France, the bark of both *Daphne Mezereum* and *D. Genkium* is used as a vesicatory.¹⁰ The mode of applying it is this: First soften the

¹ *Med. Observ. and Inq.* vol. iii. p. 194.

² Vogt, *Pharmakodynamik*. Bd. ii. S. 305, 2te Aufl.

³ *Op. supra cit.* vol. iii. p. 189.

⁴ *Observ. on the Effects of various Articles of the Mat. Med.* 1800.

⁵ *Arrangement of Brit. Plants.* vol. ii. p. 490. 7th edit.

⁶ J. A. Leroy, *Essai sur l'Usage de l'Ecorce du Garou, ou Traité des Effets des Exutoires employés contre les Maladies rebelles*, Paris, 1774.

⁷ *Ausführ. Arzneimittell.* Bd. ii. S. 193.

⁸ *Orfila, Toxicol. Gén.*

⁹ *Clin. Exper. and Hist.*

¹⁰ *Mat. Med.*

bark by soaking it in hot vinegar and water, and then apply it to the part by a compress and bandage. The application is to be renewed night and morning, until vesication is produced.

ADMINISTRATION.—Mezereon is usually administered internally, in the form of *decoction*. It is a constituent of the *decoctum sarzæ compositum* (see *ante*, p. 278).

As a *masticatory*, a few grains of the bark may be chewed.

For external use, an *ointment* prepared with the *extract* is sometimes employed.

ANTIDOTE.—In a case of poisoning by mezereon, evacuate the contents of the stomach as speedily as possible, and give emollient drinks, opiates, and the vegetable acids. To counteract inflammatory symptoms, the usual antiphlogistic treatment should be adopted.

1. DECOCTUM MEZEREI, E.; *Decoction of Mezereon*.—(Mezereon Bark, in chips, ʒij; Liquorice Root, bruised, ʒss; Water Oij. Mix them, and boil down with a gentle heat to a pint and a half, and strain.)—Stimulant and sudorific. Used in chronic rheumatism, and secondary syphilis. Dose, fʒiv to fʒviij, three or four times a day.

From Mr. Squire's observations, already referred to, it appears that ebullition is injurious to the action of mezereon, by dissipating a volatile active principle.

2. EXTRACTUM MEZEREI ALCOHOLICUM; *Alcoholic or Spirituous Extract of Mezereon*.—A tincture of mezereon is first made with rectified spirit, and the spirit then drawn off by distillation.

In the Prussian Pharmacopœia, the alcoholic extract is directed to be digested in ether, and from the ethereal tincture is obtained by distillation the *extractum mezerei æthereum*.

Extract of mezereon is greenish or brownish-green coloured, and is insoluble in water. Mr. Squire obtained a drachm of dry resin (alcoholic extract) by digesting half an ounce of the bruised bark in ten ounces of alcohol, and then distilling off the alcohol. During the distillation, none of the pungency of the root came over.

Extract of mezereon is used for the preparation of a blistering ointment or tissue.

3. UNGUENTUM MEZEREI [U. S.]; *Mezereon Ointment*.—The Prussian Pharmacopœia directs this to be prepared by mixing ʒj of the ethereal extract of mezereon with ʒj of wax ointment. In the Hamburg Codex, it is prepared by dissolving ʒij of the spirituous extract in a small quantity of spirit, and then mixing ʒviij of purified lard and ʒj of white wax.—[The U. S. Pharm. directs to take of Mezereon, sliced transversely, four ounces; Lard fourteen ounces; White Wax two ounces. Moisten the mezereon with a little alcohol, and beat it in an iron mortar until reduced to a fibrous mass; then digest it, by means of a salt-water bath, with the lard and wax previously melted together, for twelve hours; strain with strong expression, and allow the strained liquid to cool slowly, so that any undissolved matters may subside. From these separate the medicated ointment.]—The ointment is used as an irritant. Applied to ulcers or wounds, it serves to excite suppuration. Mr. Squire states that an ointment made by boiling the root in lard soon spoils by keeping.

148. *Daphne Laureola*, Linn.—Spurge-laurel.

(Cortex.)

Laureola, Gerard; Parkinson, 205.—This is another indigenous species of *Daphne*. It has drooping axillary racemes of green flowers, evergreen lanceolate leaves, and black berries. Mr. Squire says that 7 lbs. of the root yielded 4 lbs. 5 oz. of fresh bark, or 1 lb. 1½ oz. of dry bark; and 11 pounds of the stems yielded 1½ lbs. of fresh bark, which, when dried, weighed ¾ lb. The liber is remarkably tough. In odour, and irritating effect on the throat, the bark of the spurge-laurel appeared to him to be weaker than that of mezereon. Half an ounce of the bruised bark yielded him 45 grs. of alcoholic extract. In its effects, spurge-laurel resembles mezereon. Parkinson mentions its emmenagogue properties. Some years ago, a farmer gave a girl, æt. 17, three pills to procure abortion. They caused violent vomiting, convulsions (dur-

ing which she aborted), coma, and paralysis, from which she slowly recovered. A microscopic examination of the fragments of leaves in the pills led the late Mr. Edwin Quckett to believe that the poison was this plant.

149. *Daphne Gnidium*, Linn.—The Flax-leaved *Daphne*.

(Cortex.)

Θυμαλαία, Dioscorides, lib. iv. cap. 173. The berries were the κόκκοι γνιδίοι, *grana gnidia* or *gnidian berries* used by Hippocrates.¹ The properties of this species of *Daphne* resemble those of *Mezereon*. In France, the bark (called *garou*) is used in the way before described (see *Daphne Mezereum*) as a vesicatory.

ORDER XXXVIII. POLYGONACEÆ, Lindl.—BUCKWHEATS.

POLYGOÑEÆ, Jussieu.

CHARACTERS.—*Calyx* free, often coloured, imbricated in æstivation. *Stamens* very rarely perigynous, usually definite and inserted in the bottom of the calyx; *anthers* dehiscing lengthwise. *Ovary* free, usually formed by the adhesion of 3 carpels, 1-celled, with a single erect ovule, whose foramen points upwards; *styles* and *stigmas* as many as the carpels. *Ovules* orthotropical. *Nut* usually triangular, naked, or protected by the calyx. *Seed* with farinaceous albumen, rarely with scarcely any; *embryo* inverted, generally on one side, sometimes in the axis; *radicle* superior, long.—*Herbaceous* plants, rarely *shrubs*. *Leaves* alternate, their stipules cohering round the stem in the form of an ochrea (or boot); when young rolled backwards, occasionally wanting. *Flowers* occasionally unisexual, often in racemes (Lindley).

PROPERTIES.—The herbaceous plants are distinguished by their acidulous character. They owe this to the presence of vegetable acids, chiefly oxalic acid. This is found in the form of a superoxalate of potash (or soda), which communicates to the leaves and petioles refreshing and refrigerant qualities. The roots contain colouring and astringent matter, and often oxalate of lime. Some of them are purgative. The seeds of some species serve as a kind of corn for cattle, and, in times of scarcity, for man.

150. RHEUM.—RHUBARB.

Sex. Syst. Enneandria, Monogynia.

(*Rheum Sinense*; *Rhei*, species incerta; *Radix, L.* The root of undetermined species.—*E. D.*)

HISTORY.—Dioscorides² speaks of a root which he calls *rha* or *rheon* (ῥᾶ ῥῆον), and which has been regarded by some as identical with our rhubarb. "*Rha*, by some called *rheon*, grows," says Dioscorides, "in those countries which are beyond the Bosphorus, and from which it is brought. It is a root which is black externally, like to great centaury, but smaller and redder, odourless, loose or spongy, and somewhat smooth internally." Pliny³ gives a similar account of it, under the name of *rhacoma*; it comes, he says, from the countries beyond Pontus, resembles the black costus, is odourless, and has a hot, astringent taste. Prosper Alpinus⁴ was of opinion that the *rha* of Dioscorides was the root of *Rheum rhaponticum*, which Alpinus obtained from Thracia, in 1608, A. D., and cultivated at Pavia. The later Greek writers are supposed to have been acquainted with our rhubarb. Alexander of Tralles⁵ is the first who speaks of it. He used it in weakness of the liver and dysentery. Paulus Ægineta says that, in the crudities and vomiting of pregnant women, we may give "the knot-grass, boiled in water, for drink; and likewise dill, and the *pontic root*, called *rha* in the dialect of its native country;"⁶ and, in noticing the practice of the ancients, he says, "alvine discharges they promoted by giving turpentine to the extent of an olive, when going to rest; or, when they wished to

¹ See also Paulus Ægineta, Syd. Soc. edit. by Dr. Adams, vol. iii. p. 179.

² Lib. iii. cap. 11.

³ *De Rhapontico*, 1612.

⁴ Paulus Ægineta, Syd. Soc. edit. by Dr. Adams, vol. i. book i. Sect. 1, p. 1.

⁵ *Hist. Nat.* lib. xxvi. cap. 105, ed. Valp.

⁶ Lib. viii. cap. 3.

purge more effectually, by adding a little *rhubarb*," [rheon.]¹ This is the first notice of the purgative properties of rhubarb.

In one of the Arabian authors (Mesue, the younger) we find three kinds of rhubarb mentioned: The *Indian*, said to be the best; the *Barbarian*; and the *Turkish*, which is the worst of all.

BOTANY. Gen. Char.—*Calyx* petaloid, 6-parted, withering. *Stamina* about 9, inserted into the base of the calyx. *Styles* 3, reflexed. *Stigmas* peltate, entire. *Archenium* 3-cornered, winged, with the withered calyx at the base. *Embryo* in the centre of the albumen (Lindley).

It is not yet ascertained what species of *Rheum* yields the officinal rhubarb. Several species, now cultivated in this country, have been, at different times, declared to be partially or wholly the source of it. Formerly, *Rheum Rhaponticum* was supposed to yield it.²

In 1732, *R. undulatum* was sent from Russia to the Messrs. Jussieu at Paris, and to Rand of Chelsea, as the true rhubarb. This is the species which Linnæus described as *R. Rhabarbarum*.³ About 1750, at the desire of Kauw Boerhaave, first physician to the Emperor of Russia, the senate commissioned a Tartarian merchant, a dealer in rhubarb, to procure them some seeds of the genuine plant. This he did, or pretended to do; and, on sowing them, two species of *Rheum* were obtained; namely, the *undulatum* and the *palmatum*.⁴ In 1762, seeds of the latter species were received by Dr. Hope, of Edinburgh, from Dr. Mounsey, at Petersburg; they were sown, and the plants cultivated with success.⁵ The root of this species being found to agree, in many of its characters, with that of genuine rhubarb, led to the belief that the *palmatum* was the true species. The inquiries of Pallas, however, raised some doubts about the correctness of this opinion; for the Bucharians declared themselves unacquainted with the leaves of the *palmatum*, and described the true plant as having round leaves, with a few incisions only at the margin. This description agreed best with *Rheum compactum*, the roots of which were declared, by Millar, who cultivated the plant, to be as good as foreign rhubarb.⁶ Georgi says, that a Cossack pointed out to him the leaves of the *R. undulatum* as the true species.⁷ These accounts were not satisfactory to the Russians; and, in consequence, in 1790, Sievers, an apothecary, went to Siberia, under the auspices of Catherine II., with a view of settling the question; but, after four years of persevering attempts to reach the country where the true rhubarb grew, or even to obtain the seeds, he was obliged to be satisfied with negative results only. "My travels," says he, "as well as acquaintance with the Bucharians, have satisfied me that as yet nobody—that is, no scientific person—has seen the true rhubarb plant. All that is said of it by the Jesuits is miserable, confused stuff; all the seeds procured under the name of true rhubarb are false; all the plantations, from those of the Knight Murray down to the flower-pot of a private individual, will never yield true rhubarb. Until further determination, I hereby declare all the descriptions in all the *Materia Medica* to be incorrect."⁸ Calau,⁹ Apothecary in the Rhubarb Factory at Kiachta, and who, from his appointment, might be expected to know the origin of the rhubarb he receives from the Bucharians, says, "All that we know of the rhubarb plant or its origin is defective and wrong; every sacrifice to obtain a true plant or the seed has been in vain; nor has the author been enabled to obtain it. A severe prohibition from the Chinese government prevents all possibility of eliciting the truth."

Himalayan rhubarb is obtained from several species of *Rheum*: viz. *R. Emodi*, Wallich;¹⁰ *R. Webbianum*, Royle;¹¹ *R. spiciforme*, Royle; and *R. Moorcroftianum*, Royle; but there are no reasons for supposing that they yield any of the rhubarb of European commerce. It is not improbable that the species yielding the officinal rhubarb is yet undescribed. Dr. Royle,¹² after referring to the accounts of different authors, as to the precise locality of the country yielding Russian rhubarb, concludes that it is within 95° of E. long. in 35° of N. latitude—that is, in the heart of Thibet. And he adds, "as no naturalist has visited this part, and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this rhubarb."

The late Mr. Anderson, of the Apothecaries' Botanic Garden, Chelsea, furnished me with the fresh roots of thirteen species of *Rheum*: viz. *R. palmatum*, *undulatum*, *compactum*, *Rhaponticum*, *Emodi*, *crassinerivum*, *caspicum*, *tataricum*, *hybridum*, *confluens*, *Fischeri*, *bardanifolium*, and *bullatum*. Having carefully dried these by artificial heat, I found that one species only, viz. *R. palmatum*, closely resembled Asiatic rhubarb in the combined qualities of odour, colour, and marbling: *R. undulatum* agreed tolerably well in colour and marbling, but not in odour. It deserves, however, to be noticed that the specimens examined were of unequal ages—some forming the root-stock, others root-branches of the respective plants—a circumstance which considerably diminishes the value of a comparative examination of them. Furthermore, all the samples were

¹ *Ibid.* book i. Sect. 43, p. 54. See also vol. iii. pp. 317 and 478.

² Alston, *Mat. Med.* vol. i. p. 502.

³ Murray, *App. Med.* vol. iv. p. 463.

⁴ Hope, *Phil. Trans.* vol. lv. for the year 1765, p. 290.

⁵ Murray, pp. 365-6.

⁶ *Dun. an. Suppl. to the Edinb. New Disp.* p. 89.

⁷ *Bot. Mag.* t. 3508.

⁸ *Op. cit.*

⁹ *Ibid.*

¹⁰ *Ibid.* p. 360.

¹¹ *Pharm. Journ.* vol. ii. p. 658, 1843.

¹² *Illustr. of the Bot. of the Himal. Mount.*

probably injured by the wet season. The root-branches of *R. crassinerivum* (from a strong plant of six or seven years old, but which had not flowered) did not resemble Asiatic rhubarb in either colour or odour.¹

Species—I. With compound racemes.

1. *RHEUM PALMATUM*, Linn. L. D. *Palmated Rhubarb*. Commonly known to gardeners as the *True Turkey Rhubarb*.—"Leaves roundish-cordate, half palmate; the lobes pinnatifid, acuminate, deep dull green, not wavy, but uneven, and very much wrinkled on the upper side, hardly scabrous at the edge, minutely downy on the under side; sinus completely closed; the lobes of the leaf standing forward beyond it. Petiole pale green, marked with short purple lines, terete, obscurely channelled quite at the upper end. Flowering stems taller than those of any other species," (Lindley.)—Perennial. Grows spontaneously in the Mongolian empire, on the confines of China.² Its leaf-stalks make excellent tarts and puddings.

Prof. Guibourt³ observes that out of the roots of *R. palmatum*, *undulatum*, *compactum*, and *Rhaponticum*, those of the first species possess only the exact odour and taste (grittiness excepted) of the China rhubarb.

2. *RHEUM UNDULATUM*, Linn. D. *Wave-leaved Rhubarb*.—"Leaves oval, obtuse, extremely wavy, deep green, with veins purple at the base, often shorter than the petiole, distinctly and copiously downy on each side, looking as if frosted when young, scabrous at the edge; sinus open, wedge-shaped, with the lower lobes of the leaves turned upwards. Petiole downy, bloody, semicylindrical, with elevated edges to the upper side, which is narrower at the upper than the lower end," (Lindley.)—Perennial. Grows in Siberia (Georgi and Pallas, cited by Murray),² and China (Ammann, quoted by Lindley). Cultivated in France, and yields part of the *French Rhubarb*.⁴ It was formerly cultivated at Siberia as the real officinal plant; but, as genuine rhubarb could not be procured from it, its cultivation has been given up.⁵

3. *RHEUM COMPACTUM*, Linn.; *Thick-leaved Rhubarb*.—"Leaves heart-shaped, obtuse, very wavy, deep green, of a thick texture, scabrous at the margin, quite smooth on both sides, glossy and even on the upper side; sinus nearly closed by

Fig. 301.

*Rheum palmatum.*

Fig. 302.

*Rheum compactum.*

the parenchyma. Petiole green, hardly tinged with red, except at the base, semicylindrical, a little compressed at the sides, with the upper side broad, flat, bordered by elevated edges, and of equal breadth at each end," (Lindley.)—Perennial.

¹ In 1834, Geiger (*Pharm. Central Blatt für 1834*, S. 209) made a comparative examination of the roots of *R. Emodi*, *compactum*, *undulatum*, and *Rhaponticum*.

² Murray, *App. Med.* vol. iv. p. 333.

⁴ *App. Med.*

³ Guibourt, *Hist. des Drogues*.

² *Hist. Des. Drog.*

⁶ *Ibid.*

Grows in Tartary and China. Cultivated in France, and yields part of the *French rhubarb*.¹ This rhubarb is a very fair imitation of that from China; but is distinguished by its reddish tint, its different odour (common to it, to *R. undulatum*, and *R. rhaponticum*), its close and radiated marbling, its not tinging the saliva, and its not grating under the teeth.

4. *RHEUM EMODI*, Wallich; *R. australe*, Don.—“*Leaves cordate, acute, dull green, but little wavy, flattish, very much wrinkled, distinctly rough, with coarse short hairs on each side; sinus of the base distinctly open, not wedge-shaped, but diverging at an obtuse angle, with the lobes nearly turned upwards. Petioles very rough, rounded angular, furrowed; with the upper side depressed, bordered by an elevated edge, and very much narrower at the upper than the lower end,*” (Lindley.)—Perennial. Grows on the Himalayas. It yields part of the *Himalayan rhubarb*. Its stalks make excellent tarts and puddings.

5. *RHEUM WEBBIANUM*, Royle. Choor Mountain, Niti Pass. Yields part of the *Himalayan rhubarb*.

6. *RHEUM RHAPONTICUM*, Linn.; *Common or Rhapontic Rhubarb*.—Grows in Thrace; borders of the Euxine Sea; north of the Caspian; Siberia, &c. Cultivated in this country for the leaf-stalks, which are used for tarts and puddings; whence it is frequently termed *culinary* or *tart rhubarb*. Grown largely at Banbury, in Oxfordshire, on account of its roots, which, when dried, constitute *English* or *Banbury rhubarb*.² Cultivated also in France, and yields part of the *French rhubarb*.

7. *R. CRASSINERVIUM*, Fischer.—Habitat unknown. Sent from St. Petersburg to the Apothecaries' Garden, Chelsea. Its roots possess, according to the late Mr. Anderson, the colour and odour of Turkey rhubarb.³

8. *R. LEUCORRHIZUM*, Pallas; *R. nanum*, Sievers. Ledebour, Fl. Pl. Ross. t. 492. Deserts of the Kirghis, and south of Siberia and Altai Mountains. Said to yield *white* or *imperial rhubarb*.

9. *R. HYBRIDUM*, Murray, Comm. Gott. t. i.—Cultivated as a culinary rhubarb.

II. *With spiciform racemes.*

10. *RHEUM SPICIFORME*, Royle.—Kherang Pass, and other places in Kunawar. Also Thibet.

11. *RHEUM MOORCROFTIANUM*, Royle; *Small-stalked Rhubarb*.—Niti Pass, in the Himalayas. This and the preceding species have denser and more yellow roots than the two other Himalayan species of *Rheum* above noticed (viz. *R. Emodi* and *R. Webbianum*).

PREPARATION.—The method of curing or preparing Asiatic rhubarb for the market varies somewhat in different localities. In China it is as follows: The roots are dug up, cleansed, cut in pieces, and dried on stone tables, heated beneath by a fire. During the process, the roots are frequently turned. They are afterwards pierced, strung upon cords, and further dried in the sun.⁴ In Tartary, the Moguls cut the roots in small pieces, in order that they may dry the more readily, and make a hole in the middle of every piece, through which a cord is drawn, in order to suspend them in any convenient place. They hang them, for the most part, about their tents, and sometimes on the horns of their sheep.⁵ Sievers, how-

Fig. 303.

*Rheum Emodi.*

¹ Guibourt, *supra cit.*

² See note by the author, in the *Pharmaceutical Journal*, vol. vi. p. 76, 1846; also a paper by Mr. W. Biggs, in the same volume, p. 74.

³ Du Halde, *Descript. Géograph. et Hist. de la Chine*, t. iii. p. 492.

⁴ Lindley, *Fl. Med.*

⁵ Bell, *Travels from St. Petersburg to divers parts of Asia*, vol. i. p. 311.

ever, states that the roots are cut in pieces, strung upon threads, and dried under sheds, so as to exclude the solar rays; and the same author tells us that sometimes a year elapses from the time of their collection until they are ready for exportation.¹

VARIETIES AND DESCRIPTION.—The various sorts of rhubarb (*radix rhei*) of commerce may be conveniently arranged in four divisions, respectively distinguished as *Muscovitic* or *Russian*, *Canton*, *Himalayan*, and *European*.

1. Muscovitic or Russian Rhubarb (*Radix Rhei Muscovitici, Ruthenici, vel Rossici*).—Under this head are included those sorts of Asiatic rhubarb which are brought into Europe by way of Russia. The principal and chief sort is the *Crown Rhubarb*. Two other inferior sorts, called respectively *Bucharian* and *Siberian Rhapontic Rhubarb*, are occasionally imported, but are not found in the shops. *Taschkent* and *White Rhubarb* are other Russian sorts which I have not met with.

1. Russia Crown Rhubarb.—This is Chinese rhubarb, which is taken in exchange, on behalf of the Russian crown, at Kiachta. In Russia, it is known as *Chinese rhubarb*; in Europe, it is frequently called *Bucharian rhubarb*, not because it is the growth of Bucharia, but from the circumstance of a few Bucharian families having been the purveyors to the Russian crown for a century. It might with propriety be termed *Chinese-Russian rhubarb*. In English commerce, it is commonly called *Turkey rhubarb* (*radix rhei turcici*), because formerly this description of rhubarb came into Europe by way of Natolia.²

The barter of rhubarb is carried on by the Russian government, under a contract made with Bucharians at Kiachta for ten years, and confirmed by the Chinese government. According to this contract, the Bucharians undertake to furnish a certain quantity of rhubarb annually to the Russian crown, for a certain quantity of goods of a certain quality, and to deliver up all rhubarb not approved of, without remuneration, and permit it to be burnt by the Russian government.

The rhubarb grows wild in Chinese Tartary, especially in the province Kansu. It is collected on that long chain of mountains of Tartary, destitute for the most part of woods, and which arises not far from the town of Selin, and extends to the south as far as the lake Kokonor, near Thibet.³ It is generally gathered in summer, from plants of six years of age. When the root is dug up it is washed, to free it from earthy particles, peeled, bored through the centre, strung on a thread, and dried in the sun. In autumn, all the dried rhubarb collected in the province is brought in horse-hair sacks, containing about 200 lbs. to Sinin (the residence of the dealers), loaded on camels, and sent over Mongolia to Kiachta, Canton, Macao, and partly to Pekin. All the rhubarb brought to Kiachta undergoes an examination, prescribed by the Imperial Russian Medical Council, according to directions of the Russian government. The selection of the rhubarb bartered for by Russian merchants takes place in the custom-house at Kiachta; and of that for the crown, in a house for that purpose on the Chinese borders.

In this selection, the following rules are chiefly to be observed:—⁴

a. To reject pieces obtained from dead plants, which are porous, of a gray colour, and, besides fibre and oxalate of lime, contain little of the other constituents of rhubarb.

b. To reject pieces that are small, derived from young plants, and which are of a pale colour, and without much virtue.

c. To reject roots of other plants, which are casually or purposely mixed with the rhubarb.

d. To pare the rhubarb. This is done, first, to remove remaining portions of the bark and the upper part of the root; and, secondly, to cleanse those parts that may be stained with the sweat of the camels.

e. To perforate all pieces, and examine their interior.

f. To re-dry those roots which may be moist.

As the rhubarb taken in exchange by the crown is not permitted to be imported into the European part of Russia, except in quantities of 1,000 poods, or 40,000 pounds, the roots approved of, after the examination, are packed in bags, and placed where there is a free current of air, until the necessary quantity has accumulated, which is then packed in cases capable of containing 4—5 poods. These chests are covered with linen and pitched, then sewed into skins and marked with the year of the importation of the root, and sent to Moscow.

Crown rhubarb is imported in chests holding from 156 to 160 lbs. each. Each chest is pitched on the outside and covered with a hempen cloth and a hide. On the outside of the chest is a printed paper, stating the year in which the rhubarb

¹ Duncan, *Suppl. to the Edinb. New Disp.* p. 88.

² Murray, *App. Med.* vol. iv. p. 379.

³ Pallas, *Voyages en diff. Prov. de l'Empire de Russie*, t. iv. p. 216, et seq.

⁴ Calau, *Pharm. Journ.* vol. ii. p. 658, 1843.

was imported into Russia, and the weight of the chest. The following is a literal copy (reduced in size) of one of these papers:—¹

RAD: RHEI PALMAT:

КИТАЙСКИЙ КОПЫТЧАТЫЙ РЕВЕНЬ

ПАРТИИ 1840 ГОДА.

№ 6

ЧИСТАГО ВЪСУ ^{пудъ} **4.** ^{фунт.} **- 26**

The best prices are obtained for those chests whose rhubarb is in small pieces (for retailing), has a bright colour, and is sound and hard. The shapes of the pieces are various, being angular, rounded, irregular, &c. The flat surfaces and angles which the pieces present show that the cortical portion of the root has been removed by slicing (and not by scraping, as in the Canton rhubarb). Holes are observed in some of the pieces extending completely through; they have been made for the purpose of hanging the pieces to dry; but all traces of the cord have been carefully removed, and the holes scraped or filed to get rid of all decayed portions. The holes which extend only partially through the pieces are borings which have been made to examine the condition of the interior of the pieces.

Externally, the pieces are covered with a bright yellow-coloured powder, usually said to be produced by the mutual friction of the pieces in the chests during their passage to this country; though many druggists believe it is derived from the process of *rouncing* (that is, shaking in a bag with powdered rhubarb), before its exportation. The odour is strong and peculiar, but somewhat aromatic. It is considered by druggists to be so delicate, that in all wholesale drug-houses a pair of gloves is kept in the Russian rhubarb drawer, with which only are the assistants permitted to handle the pieces. When chewed, it feels gritty under the teeth, from the presence of numerous crystals of oxalate of lime; it communicates a bright yellow colour to the saliva, and has a bitter, slightly astringent taste.

Beneath the dust with which the pieces are covered, the surface has a reddish-white tint, owing to the intermixture of white and red parts. The yellowish-white parts have the form of lines or veins, which, by their union with each other, assume a reticular form. Irregularly scattered over the surface we observe small star-like spots and depressions, of a darker colour. The transverse fracture is uneven, and presents numerous brownish-red or dark carmine-coloured undulating veins. The

¹ The following is a translation of the above label:—

RAD: RHEI PALMAT:

CHINESE HOOF RHUBARB

OF THE YEAR 1840.

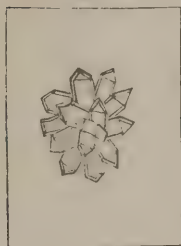
N^o 6

poods. lbs.

NET WEIGHT 4. — 26

longitudinal fracture is still more uneven, and shows the longitudinal direction of the veins, which are often interrupted with white. The surface obtained by cutting is more or less yellow, and often exposes the veins, disposed in groups.

Fig. 304.



Crystals of Oxalate
of Lime in Russian
Rhubarb.

By boiling very thin slices of the root in water, and then submitting them to the microscope, we observe cellular tissue, annular ducts, and numerous *conglomerate raphides* (clumps of crystals of oxalate of lime). From 100 grs. of Russian rhubarb, the late Mr. Edwin Quekett procured between 35 and 40 grs. of these raphides.¹ Turpin considered the presence of these crystals sufficient to distinguish Russian and Chinese rhubarb from that grown in Europe; but in some specimens of English rhubarb I have met with them in as great abundance as in foreign rhubarb. According to Raspail,² they are situated in the interstices of the elongated tissue; but this statement is erroneous, the situation of the crystals being in the interior of the cells.

The small pieces of crown rhubarb are usually picked out and sold as *radix rhei turcici electa*; the larger pieces and dust being employed for powdering.

The powder of Russian rhubarb is of a bright yellow colour, with a reddish tint; but, as met with in the shops, it is almost invariably mixed with the powder of English rhubarb.

2. *White or Imperial Rhubarb*.—When Pallas was at Kiachta, the Bucharian merchants, who supplied the crown with rhubarb, brought some pieces of rhubarb as white as milk, with a sweet taste, and the same properties as rhubarb of the best quality.³ It is not met with in English commerce as a distinct kind; and it is almost unknown in Russia.⁴ But in the chests of Russian rhubarb there are occasionally found pieces having an unusually white appearance; these I presume to be the kind alluded to.⁵ White rhubarb is said to be the produce of *R. leucorrhizum*, Pallas (*R. nanum*, Sievers.)

3. *Taschkent Rhubarb*.—This is the refuse of the true Russian rhubarb, which comes by way of Taschkent. It differs but little from the crown rhubarb. On account of its cheapness, it, like the Bucharian sort, is employed for purposes for which the crown rhubarb of Russia is too expensive. I have not met with it in English commerce.

4. *Bucharian Rhubarb* (*Rheum bucharicum*).—Grassman, an apothecary, at St. Petersburg, who has described this sort,⁶ considers it to be the rhubarb which, according to Pallas, is obtained from *Rheum undulatum*, and which, in the *Pharmacopœia Rossica*, for 1798, was denominated *radix rharbarbi sibirici*. As it is not under the control of the crown, in Russia, it undergoes no examination, and inferior and rotten pieces, therefore, are often met with. On account of its cheapness it is used, in Russia, in veterinary medicine.

In 1840, some of it was received here by Mr. Faber, from Russia, to whom I am indebted for samples of it. It is described as being carried into the latter country by way of Nischny, where it is trimmed for the Moscow market.

This kind of rhubarb is intermediate between the Chinese and Russian or Muscovite rhubarb, but is of inferior quality. The pieces are, more or less, rounded or flattened, and weigh from one to two ounces each. Some of them appear to have been deprived of their cortical portion by scraping, as in the Chinese rhubarb; but in others, the cortex has been removed by slicing. Most of them are perforated by a hole, apparently for the purpose of drying them; but in none of the holes are there any remains of the cord used in suspending the roots. The holes, moreover, appear to have been cleaned out, as in the Russian rhubarb, for no portion of decayed rhubarb is seen in them. Some of the pieces are dense, but most of them are lighter than good Russian rhubarb. Internally, they are often decayed and dark coloured. Their texture is similar to that of genuine rhubarb. The odour is also like that of rhubarb, but much feebler; the taste is bitter and astringent. When chewed, this rhubarb feels gritty under the teeth. Its colour is darker than that of good Russian rhubarb.

5. *Siberian Rhubarb*; *Rheum sibiricum*.⁷—This is the sort which Grassman has described as *Siberian rhapontic rhubarb*. In 1845, three chests of it came to England from St. Petersburg, under the name of *Bucharian rhubarb*, and were sold by public sale at 6d. per lb.

¹ Lindley's *Introduction to Botany*, 3d ed. p. 553.

² *Chim. Organ.*

³ Grassman; *Buchner's Repert.* Bd. xxxviii. S. 179, 1831.

⁴ Consult Gœbel and Kunze, *Pharm. Waarenkunde*.

⁵ *Buchner's Repertorium*, Bd. xxxviii. S. 179, 1831.

⁷ For a notice of this and two preceding varieties, see a paper by the author in the *Pharmaceutical Journal*, vol. iv. pp. 445 and 500, 1845.

² *Voyages*, t. iv. p. 219.

In its general appearance, it agreed with rhubarb grown in this country, and known as English stick rhubarb. It had been decorticated, though imperfectly so, as portions of the dark brown cortex were here and there left adherent. The pieces were all more or less cylindrical, seldom exceeding four inches in length and an inch in diameter, and on the average weighed about 100 grains each; the longest piece was six inches in length, and an inch and a half in diameter. The broadest piece was somewhat flattened, and about three inches in its broadest diameter. Its colour was, in general, darker than that of the ordinary rhubarb, but was of the same kind of tint. Its odour was remarkably sweet, similar to what I have perceived when drying the roots of different species of *Rheum* cultivated in England. When chewed it was not gritty. Its taste was mucilaginous, bitterish, but not astringent. The fracture of the smaller and sound pieces was similar to that of English stick rhubarb; the larger pieces were decayed, dark brown, and tasteless in the centre.

2. Canton Rhubarb.—This, like the Russian crown rhubarb, is the produce of China, but is exported from Canton. It is usually known in English commerce as *Chinese* or *East Indian rhubarb* (*radix rhei chinensis* seu *indici*.) It is imported either directly from Canton, or indirectly by Singapore and other parts of the East Indies, and is probably the produce of the province of Se-tchuen (Du Halde), of Hoo-nan and Hoo-pih, as well as of other provinces (Gutzlaffe and Reed).

Three kinds of Canton rhubarb are known in commerce; these are, the *untrimmed* or *half-trimmed*, the *trimmed*, sometimes called the *Dutch trimmed*, and what I have called *stick rhubarb*.

6. Half-trimmed or untrimmed Canton Rhubarb.—This is usually *Chinese* or *East Indian rhubarb* of the shops. It is called “untrimmed,” or “half-trimmed,” because the cortical portion of the root has been incompletely scraped (not sliced) off; and consequently the pieces have a rounded character, and are devoid of the flat surfaces and angles produced by slicing (as in the Russian and Dutch trimmed rhubarbs). The inferior pieces present the remains of the greenish-brown or blackish cortex. The pieces are frequently cylindrical or roundish, but sometimes flattened; in trade, they are distinguished as *rounds* and *flats*. They are generally perforated with holes, in many of which, we find portions of the cords by which they were suspended. These holes are smaller than those observed in Russian rhubarb, and that portion of the root forming their sides is usually dark-coloured, decayed, and of inferior quality. The best pieces are heavier and more compact than that of the Russian kind; and are covered with an easily separable dust. When this is removed, we observe that the surface is not so regularly reticulated, is of a more yellowish-brown than reddish-white colour, and has coarser fibres than Russian rhubarb. On the finer pieces, we notice numerous star-like spots or depressions. The fracture is uneven; the veins, especially towards the middle, have a less determinate direction, and are of a duller or reddish-brown colour, and, in very bad pieces, of an umber-brown colour, with a gray substance between the veins.

The odour of this species is much less powerful than that of Russian rhubarb, and is somewhat less aromatic. The taste, grittiness when chewed, and microscopic appearances, are similar to those of Russian rhubarb. The colour of the powder is of a more dull yellow or brownish cast.

This sort of rhubarb is imported in chests and half chests; the former contains one picul (133½ lbs.), the latter half a picul. The chests are oblong, have been coarsely put together, and, except in shape, resemble tea-chests; and, like the latter, are lined with sheet-lead. The cover is a double one.

When this sort arrives in London, it is hand-picked, tared, and sorted into three qualities—bright and sound, dark and horny, and worm-eaten. This is not done with Russian rhubarb.

7. Dutch-trimmed or Batavian Rhubarb, offic. (*Rhubarbe de Perse*, Guibourt.)—This kind of rhubarb is closely allied to, if it be not identical with, the preceding in its texture. In commerce, however, it is always regarded as distinct. It is imported from Canton and Singapore in chests, each containing one picul, (133½ lbs.) It has been dressed or trimmed to resemble the Russian crown rhubarb, which it does in shape, size, and general appearance; for the cortical portion of the

root seems to have been separated by slicing, and hence the pieces have the same angular appearance on the surface that the Russian rhubarb has. The pieces are frequently perforated, and in the holes are found the remains of the cord by which the root has been suspended; in this it differs from the Russian crown rhubarb. In the drug-trade, this kind of rhubarb is said to be trimmed, and, according to the shape of the pieces, they are called *flats* or *rounds*. The colour and weight of the pieces are variable.

8. *Canton Stick Rhubarb*.—In 1844, five cases of this rhubarb were imported from Canton, and were sold by public sale, at 8d. per pound.

All the pieces but one of my sample are cylindrical, about two inches long, from half to three-quarters of an inch in diameter, and weigh each on the average about 100 grains. The piece to which I have referred as forming the exception is shaped like a flattened cylinder, cut obliquely at one end; its greatest length is about two and a half inches, its greatest breadth two inches and a quarter; while its depth is about one inch, and its weight is about two ounces. Mr. Faber, from whom I received it, tells me, that on the examination of a quantity of Canton stick rhubarb he found several such pieces.

Most of the pieces are decorticated. These resemble English stick rhubarb in their texture and colour, except that they are, perhaps, somewhat paler. The taste is bitter, and somewhat astringent, but considerably less so than that of good, half-trimmed, Canton Rhubarb. By chewing it, little or no grittiness is perceptible.

This kind of rhubarb is probably obtained from the root-branches of the plant which yields the usual Canton rhubarb.

3. *Himalayan Rhubarb* (*Radix Rhei Himalayanensis*; *Radix Rhei Indici*).—Rhubarb, the produce of the Himalayas, which makes its way through the plains of India, through Kahlsee, Almora, and Butan, is probably, from its usual dark colour and spongy texture, the produce of either or both *R. Emodi* and *R. Webbiana*; the roots of *R. spiciforme* and *R. Moorcroftianum* being lighter coloured and more compact in structure.

I have met with two sorts of Himalayan rhubarb:—

9. *Large Himalayan Rhubarb*; *Rhubarb* from *Rheum Emodi*?—I am indebted to Dr. Wallich for some specimens of this sort of rhubarb. He obtained them from the inhabitants of the Himalayas, who had strung the pieces around the necks of their mules. It has scarcely any resemblance to the official rhubarb. The pieces are cylindrical, and are cut obliquely at the extremities; the cortex of the root is not removed; the colour is dark-brown, with a slight tint of yellow; they are without odour, and have a coarse fibrous texture.

In November, 1840, when China rhubarb was very scarce and dear, nineteen chests of Himalayan rhubarb were imported from Calcutta into this country. The chests were of the usual Calcutta kind, made of the hard, heavy, brittle Bengal wood. The weight per chest was gross 1 cwt. 2 qrs. 26 lbs.

The pieces varied considerably in size and shape; some were twisted, cylindrical, furrowed pieces, cut obliquely at the extremities, about four inches long, and an inch and a half in diameter. Others were circular disks, about three inches in diameter, two inches thick, and weighed about four ounces each. Besides these, semicylindrical, angular, and other-shaped pieces were met with, and were obviously obtained by slicing the root. Some of the pieces were decorticated, others were coated. The general colour was dark brown; the prominent decorticated and paler parts having an ochre-brown tint. It had a feeble rhubarb odour, and a bitter astringent taste. When broken, it did not present the marbled texture characteristic of ordinary rhubarb. By chewing it, little or no grittiness was perceived. It was exceedingly light, and worm-eaten.

This was the first shipment of Himalayan rhubarb ever made to this country. Two chests sold at 4d. per lb.; the remainder at 1d. per lb.²

10. *Small Himalayan Rhubarb*; *Rhubarb* from *Rheum Webbiana*.—I am indebted to Dr. Royle for this sort. It is the same as that referred to in the ex-

¹ See a paper by the author in the *Pharmaceutical Journal*, vol. iv. p. 446, 1845.

² Dr. Royle (*Illustr. of the Botany of the Himalayan Mountains*, p. 316) says that the Himalayan rhubarb sells for only one-tenth of the price of the best rhubarb, resembling in quality the Russian, and which is found in India.

periments of Mr. Twining.¹ The pieces are short transverse segments of the root-branches, of a dark brownish colour, odourless, or nearly so, with a very bitter astringent taste, and in quality do not essentially differ from the roots given me by Dr. Wallich.

4. *European Rhubarb* (*Radix Rhei Europæi*).—This is rhubarb cultivated in Europe. The only two sorts with which I am acquainted are the English and French.

11. *English Rhubarb* (*Radix Rhei Anglici*).—This is the produce of *Rheum Rhaponticum*, cultivated in the neighbourhood of Banbury in Oxfordshire.

The history of this rhubarb is not a little curious. It appears that Mr. Wm. Hayward, an apothecary at Banbury, was the original cultivator of rhubarb in that locality. From his own statement² it appears that he began to cultivate it about the year 1777.³ In 1789 he obtained a silver medal, and in 1794 a gold medal, from the Society of Arts, for the cultivation of what he terms "the true Turkey rhubarb;"⁴ the plant for which the Society offered the premium being the "*R. palmatum*, or true rhubarb."⁵ Mr. Hayward died in 1811, and his plants were purchased by the father of one of the present cultivators.

At present there are three cultivators of Banbury rhubarb; viz. Mr. R. Usher of Overthorpe and Bodicott, Mr. T. Tustian of Milcombe, and Mr. E. Hughes of Neithorp. These parties grow altogether about 12 acres of rhubarb. Only one species is in cultivation, and that I find to be *R. rhaponticum*. I have examined specimens of it sent to me by Mr. Rye, surgeon of Banbury, and to the Pharmaceutical Society by Mr. W. Bigg. Mr. Usher states that no other species was ever cultivated at Banbury; and that he cannot produce English rhubarb from the "Giant rhubarb," or any other sort.⁶

At Banbury, the rhubarb is obtained from roots of three or four years old. They are dug up in October or November, freed from dirt, deprived of their outer coat by a sharp knife, exposed to the sun and air for a few days, and dried on basket-work in drying-houses heated by stove-pipes or brick flues. Mr. Hayward accelerated the curing process by scooping a hole in the largest pieces; and dried both these and the smaller pieces strung on packthread, and hung in a warm room.

The root-stock yields the *trimmed English rhubarb*; the root-branches yield the *cuttings* or *stick English rhubarb*. The produce of the process of trimming is called *raspings*, and serves for powdering.

Trimmed or dressed English rhubarb is the kind frequently observed in the show-bottles of druggists' windows, and was formerly sold in Cheapside and the Poultry for "*Turkey rhubarb*," by persons dressed up as Turks. It occurs in various-sized and shaped pieces, which are trimmed and frequently perforated, so as to represent foreign rhubarb;⁷ some of the pieces are cylindrical in their form, and are evidently segments of cylinders; others are flat. This kind of rhubarb is very light, spongy (especially in the middle of the large flat pieces), attractive of moisture, pasty under the pestle, and has a reddish or pinkish hue not observed in the Asiatic kind. Internally it has usually a marbled appearance; the streaks are pinkish, parallel, and have a radiated disposition; and in the centre of some of the larger pieces the texture is soft and woolly, and may be easily indented by the nail. Its taste is astringent and very mucilaginous; it is not at all, or only very slightly, gritty under the teeth; its odour is feeble, and more unpleasant than either the Russian or East Indian kinds. The microscope discovers in it, for the most part, very few crystals of oxalate of lime.

The *common stick English rhubarb* (called at Banbury the *cuttings*) occurs in angular or roundish pieces, of about five or six inches long, and an inch thick. When fractured it presents the radiated appearance, and the red-coloured streaks, of the kind last mentioned. Its taste is astringent, but very mucilaginous; it is not gritty under the teeth; it breaks very short.

¹ *Trans. Med. and Phys. Soc. of Calcutta*, vol. iii. p. 411.

² *Trans. Society of Arts*, vol. viii. pp. 75 and 76, 1790.

³ The cultivation of rhubarb in Britain was long since recommended by Sir William Fordyce, in a work entitled *The Great Importance and Proper Method of Cultivating and Curing Rhubarb in Britain, for Medical Purposes*, Lond. 1784.

⁴ *Trans. Society Arts*, vol. xii. pp. 225-229, 1794.

⁵ *Ibid.* vols. vii. p. 281, and xi. p. 285.

⁶ For further details see Mr. Bigg's *Answers to Queries* (drawn up by the author), and the author's *Note on Banbury Rhubarb*, in the *Pharmaceutical Journal*, vol. vi. pp. 73, 74, and 76.

⁷ Specimens in the Russian or Dutch style of trimming, in the Chinese or East India style of trimming, and of small trimmed pieces like truncated cones and fine trimmed Banbury rhubarb, are contained in the museum of the Pharmaceutical Society.

English rhubarb is extensively employed by druggists to adulterate the powder of Asiatic rhubarb.

12. *French rhubarb* (*Radix Rhei Gallici*).—This kind of rhubarb is procured from *Rheum Rhaponticum*, *undulatum*, and especially *compactum*.¹ These are cultivated at Rheupole, a place not far from Lorient, in the department of Morbihan. *Rheum palmatum* is no longer cultivated there. Through the kindness of Professor Guibourt, I possess two kinds of French rhubarb. One of these he calls *flat*, and is probably the produce of *R. rhaponticum*; the other he terms *round*, and is the produce of *R. compactum*.

COMPOSITION.—Few, if any, articles of the materia medica have been so frequently the subject of chemical investigation as rhubarb. Many chemists have submitted it to examination for the purpose of discovering all its proximate principles. Among these, may be mentioned Schrader² in 1807, N. E. Henry³ in 1814, Brande⁴ in 1821, Hornemann⁵ in 1822, Peretti⁶ in 1826, Buchner and Herberger⁷ in 1831, Lucas⁸ in 1833, O. Henry⁹ in 1836, Brandes¹⁰ in 1836, and Schlossberger and Doepping in 1844.¹¹

But several of the more important chemical examinations of rhubarb have been made with the view chiefly of discovering the one or more active principles of rhubarb. Among these I include the investigations of Trommsdorff,¹² Pfaff,¹³ Nani,¹⁴ Caventou,¹⁵ Carpenter,¹⁶ Dulk,¹⁷ and especially of Schlossberger and Doepping, before quoted.

One hundred grains of the finest Russian rhubarb, according to Mr. Brande, lost 44.2 grs. by being repeatedly digested in alcohol (sp. gr. 0.815). By evaporation, the alcoholic solution yielded a residue of 36 grains (the loss 8.2 grs. may be ascribed to water), of which 10 grains (resin?) were insoluble in water.

The rhubarb left after the action of alcohol weighed, when dried at 212° F., 55.8 grs. It yielded to water 31 grs. (gum?) The insoluble residue, weighing 24.8 grs., must have consisted of woody fibre, oxalate of lime, &c.

	Hornemann's Analyses.			Lucas's Analysis.
	Russian.	English [Chinese?]	Sicilian [English?]	Rheum Emodi.
Bitter principle of Pfaff	16.042	14.375	10.156	4.220
Yellow colouring matter of Henry	9.583	9.166	2.187	7.500
Astringent extractive	14.687	16.458	10.417	6.458
Oxidized tannin	1.458	1.249	0.833	0.469
Mucilage	10.000	8.333	3.542	6.250
Substance extracted by potash lye	28.333	30.416	41.042	55.833
Oxalic acid	1.042	0.833	...	1.302
Woody fibre	14.583	15.416	8.512	16.334
Moisture	3.333	3.125	6.042	...
Rhaponticin . . . . .	...	...	1.042	...
Starch . . . . .	...	...	14.583	...
Loss [water and odorous matter?]	0.939	0.629	1.614	1.604
Rhubarb	100.000	100.000	100.000	100.000
The woody fibre being incinerated, yielded—				
Potash	trace	trace	The quantities of potash, lime, alumina, and magnesia, were too small to be accurately determined.	...
Charcoal	0.208	0.208		0.208
Silica	2.416	0.416		0.155
Carbonate of magnesia	0.208	0.208		0.208
Alumina with oxide of iron	0.208	0.208		0.572
Carbonate of lime	5.683	7.083		3.534
Ashes	8.873	8.123	...	4.997

¹ Guibourt, *op. supra cit.*

² *Berlinisches Jahrbuch f. d. Pharmacie auf das J. 1807*, p. 123.

³ *Bull. de Pharm.* vi. 87, 1814.

⁴ *Berl. Jahrb.* Bd. xxiii. p. 252, 1822.

⁵ Buchner's *Repertor.* B. l. xxxviii. p. 337, 1831.

⁶ *Journ. de Pharm.* xxii. 393, 1836.

⁷ *Ann. der Chem. u. Pharm.* Bd. l. p. 196, 1844; and *Pharm. Journal*, vol. iv. p. 436, 1844.

⁸ *Journ. de Pharm.* iii. 1, p. 106.

⁹ *Syst. d. Mat. Med.* Bd. iii. p. 23, 1814; and Bd. vi. p. 308, 1821.

¹⁰ *Biblioth. Univ.* xxxiii. 232.

¹¹ *Philadelphia Journal of Pharmacy*, vol. i. p. 139.

¹² *Arch. d. Pharm.* Bd. xvii. p. 26; also, *Pharm. Central-Blatt für 1839*, p. 102.

¹³ *Quart. Journ. of Science*, vol. x. p. 285, 1821.

¹⁴ *Journ. de Pharm.* xiv. 536, 1828.

¹⁵ *Ibid.* für 1834, p. 78.

¹⁶ *Pharm. Central-Blatt für 1836*, p. 182.

¹⁷ *Journ. de Pharm.* t. xii. p. 22, 1826.

Brandes's Analysis.

(Chinese Rhubarb.)

Pure rhabarberic acid	2.0
Impure rhabarberic acid	7.5
Gallic acid, with some rhabarberic acid	2.5
Tannin	9.0
Colouring extractive	3.5
Uncrystallizable sugar, with tannin	11.0
Starch and pectic acid	4.0
Gummy extractive taken up by caustic potash	14.4
Pectic acid	4.0
Malate and gallate of lime	1.1
Oxalate of lime	11.0
Sulphate of potash, and chloride of potassium	1.5
Phosphate of lime with oxide of iron	0.5
Silica	1.0
Woody fibre	25.0
Water	2.0

Rhubarb 100.0

Schlossberger and Doepping's Analysis.

(Moscow and Chinese Rhubarb.)

1. Chrysophanic acid.
2. Three resins (aporetine, phæoretine, and erythroretine.)
3. Extractive matter.
4. Tannic acid.
5. Gallic acid.
6. Sugar.
7. Pectine.
8. Oxalate of lime.
9. Ashes (containing potash, soda, silica and sand, traces of sesquioxide of iron, phosphate of lime and magnesia, sulphuric, muriatic (chlorine), phosphoric and carbonic acids.

Rhubarb.

Schlossberger and Doepping conclude that the flavour, relation to chemical reagents, and therapeutical properties of rhubarb, depend on the conjoint operation of the resin, the colouring matter, and the extractive; modified perhaps in some degree by the other ingredients.

1. **ODOROUS MATTER OF RHUBARB (Volatile Oil?).**—In none of the analyses of rhubarb is any mention made of a distinct odorous principle; yet it appears to me that such must exist. As the colour and odour bear no proportion to each other in different kinds of rhubarb, it is tolerably clear, that they cannot depend on one and the same principle. The odorous principle is probably a volatile oil, but it has not hitherto been isolated. A few years since, Dr. Bressy announced to the *Académie de Médecine* that he had separated it, but the committee appointed to repeat his experiments was unable to procure it by his process.¹ Zenneck² says that the rhubarb odour is imitated by a mixture of nitric acid, aloes, and chloride of iron.

2. **YELLOW CRYSTALLINE GRANULAR MATTER OF RHUBARB.** *Chrysophanic Acid* (so called from χρυσός, gold, and φαίνω, I shine); *Rheic Acid*. $C^{10}H^8O^9$. Found in Russian and Canton rhubarb; in the roots of *Rheum Rhaponticum* and *Rumex obtusifolius*; and in *Parmelia parietina* (see *ante*, p. 69). In the pure or more or less impure state, it has been long known under the names of *rhabarberic acid*, *rheumin*, *rhabarberin*, and *rhein*. It may be procured from rhubarb by means of ether in Robiquet's displacement apparatus.

Pure chrysophanic acid is a beautiful, clear, yellow, odourless, and tasteless substance, which separates in granular masses, and shows little disposition to crystallize. It is tolerably soluble in hot rectified spirit of wine; not very soluble in ether, even when boiling; and almost insoluble in cold water, but more soluble in boiling water. Heated, it evaporates, emits yellow fumes which condense and form yellow flocculi, and at the same time a part becomes carbonized. It dissolves in alkalis, producing a beautiful red colour; if the potash solution be evaporated to dryness, the red colour changes to violet, and then to a beautiful blue. It dissolves in oil of vitriol, forming a beautiful red solution, from which water precipitates yellow flocculi.

3. **RESINS.** According to Schlossberger and Doepping, rhubarb contains three resins, soluble in alcohol, but insoluble in water.

a. *Aporetine* (from ἀπο, from, and ῥηίνη, resin) is a product or deposit of the resin of rhubarb. It is black and shining when dry; slightly soluble in hot spirit, ether, cold and hot water; very soluble in ammonia and potash.

β. *Phæoretine* (from φαῖς, red brown, and ῥηίνη); *Brown resin* of rhubarb. $C^{16}H^8O^7$. It is yellowish brown, very slightly soluble in water and ether; very soluble in spirit and its alkalis, and may be thrown down from the latter solution by the mineral acids.

γ. *Erythroretine* (from ἐρυθρός, red, and ῥηίνη); *Red resin* of rhubarb. $C^{19}H^9O^7$. It is yellow, soluble in ether, very soluble in alcohol; forms rich purple combinations with potash and ammonia, which are very soluble in water. To this resin, as well as to chrysophanic acid, rhubarb chiefly owes its colour.

4. **BITTER PRINCIPLE; Extractive?** Rhubarb contains a bitter principle; but most of the substances which have been announced as the bitter principle of rhubarb, under the name of *caphopierite* (! from καφίη, I exhale, and πικρός, bitter), or *rhabarberin*, are themselves compounded of two or more principles. Schlossberger and Doepping describe the extractive matter of rhubarb as having a bitter taste, but not the flavour of rhubarb.

5. **ASTRINGENT MATTER (Tannic and Gallic acids).**—The red veins are the seat of the astringent matter. This is proved by brushing the cut surface of rhubarb with a weak solution of a ferruginous salt; the red veins only undergo a change of colour.

6. **INDIFFERENT SUBSTANCES.**—Rhubarb contains a considerable quantity of *starch* and *pectine* or vegetable jelly. The starch consists of small grains, with a very distinct nucleus or hilum, and arranged in groups, each of 2, 3, or more grains. Sugar also may be detected by Trommer's test and fermentation (see *ante*, p. 150). Cellulose and mucilage also are present.

¹ Dict. des Drog. t. iv. p. 425.² Pharm. Central-Blatt für 1832, S. 237.

7. **OXALATE OF LIME.**—The conglomerate raphides before noticed (see *ante*, p. 426) are crystals of oxalate of lime. They may be separated in great abundance by boiling Russian or China rhubarb in water until the cohesion of the tissue is completely destroyed. When the decomposed tissue is well shaken with water, the crystals fall to the bottom of the vessel. Heated to redness, they are changed into carbonate of lime. A solution of them in diluted nitric acid, or a solution obtained by boiling the crystals with a solution of carbonate of soda, forms, with nitrate of silver, a white precipitate (*oxalate of silver*), which explodes when heated. It has been already stated that the late Mr. Edwin Quekett obtained from 35 to 40 per cent. of oxalate of lime from Russian rhubarb.

8. **RHAPONTICIN.**—A yellow, crystallizable, odourless, tasteless substance, obtained from the root of European (English?) rhubarb. It is insoluble in cold water, ether, and the volatile oils, but soluble in 24 times its weight of boiling water, and twice its weight of absolute alcohol.

CHEMICAL CHARACTERISTICS.—If the powder of rhubarb be heated in a glass capsule over a lamp, an odorous yellow vapour (*oil?* or *resin with chrysophanic acid*) is obtained, which communicates a red colour to a solution of caustic potash. The aqueous infusion of rhubarb is rendered green by the sesquichloride of iron (*tannogallate of iron*); with a solution of gelatin it yields a copious yellow precipitate (*tannate of gelatin*), which is dissolved on the application of heat, or by the addition of an excess of gelatin; with a solution of disulphate of quinia, a yellowish precipitate (*tannate of quinia*); with the alkalies (potash, soda, and ammonia), a red-coloured solution (*soluble alkaline chrysophanates*); with lime-water, a reddish precipitate (*chrysophanate of lime*); with the acids (the acetic excepted), precipitates; and with various metallic solutions (as of acetate of lead, protochloride of tin, protonitrate of mercury, and the nitrate of silver), precipitates (principally *metallic chrysophanates and tannates*).

Distinguishing characteristics of rhubarb and turmeric.—Paper stained by a strong decoction of tincture of rhubarb is not affected by boracic acid, or by the borates rendered acid, whereas turmeric paper is reddened by these agents.² Hence the presence of turmeric in powdered rhubarb may be detected by this means.

Differential characteristics of the commercial sorts of rhubarb.—All the different commercial sorts of rhubarb contain the same constituents, but in different proportions; hence the differential characteristics are founded on relative or comparative differences, not on absolute ones. English rhubarb usually contains a smaller quantity of crystals of oxalate of lime, and a larger quantity of starch. It, therefore, is less gritty between the teeth. In general, a decoction of Russian, Dutch-trimmed, or of China rhubarb, becomes, with a solution of iodine, greenish-blue (*iodide of starch*): after a few minutes the colour disappears, and no iodine can be detected in the liquor by starch, unless nitric acid be previously added. A decoction of English rhubarb, however, is rendered, by a solution of iodine, intensely blue (*iodide of starch*), the colour not completely disappearing by standing. These peculiarities, however, are not constant. Some specimens of Russian rhubarb, however, contain so much starch that they react on iodine, like those of English rhubarb.

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—On the *solipedes* rhubarb acts as a tonic, confining its action principally to the stomach, whose digestive power it augments. On the *carnivora* it operates, in doses of half a drachm, in the same way; but, in doses of several drachms, as a purgative. On the larger *herbivora* it may be given to the extent of several ounces without causing purgation.³ Tiedemann and Gmelin⁴ detected it by its yellow colour in the serum of the blood of the mesenteric, splenic, and portal veins, and in the urine of dogs to which rhubarb had been administered by the mouth. They failed to recognize it in the chyle.

β. On Man.—In small doses (as from four to eight grains) it acts as an astringent tonic, its operation being principally or wholly confined to the digestive organs. In relaxed conditions of these parts it promotes the appetite, assists the digestive process, improves the quality of the alvine secretions, and often restrains diarrhoea. In large doses (as from a scruple to a drachm) it operates, slowly and mildly, as a

¹ Berzelius, *Traité de Chim.* vi. 205.

² Moiroud, *Pharm. Vétér.* p. 260.

⁴ *Versuche ü d. Wege auf welch. Subst. aus d. Magen u. Darmk. gelang.* S. 10–12

² Faraday, *Quart. J. urn. of Science*, vol. vi. p. 152.

purgative, sometimes causing slight griping. It never inflames the mucous membrane of the alimentary canal, as jalap, scammony, colocynth, and some other drastic purgatives are capable of doing. The constipation which follows its cathartic effect has been ascribed to the operation of its astringent matter. In febrile complaints and inflammatory diseases it sometimes accelerates the pulse, and raises the temperature of the body; whence the impropriety of its use in these cases.

Under the use of rhubarb the secretions, especially the urine, become coloured by it. According to Heller, the colour which the urine acquires under the employment of this medicine depends on the acid or alkaline condition of this secretion; if acid, it is yellow; if alkaline, it becomes reddish-yellow or blood-red. From Schlossberger's experiments,¹ it appears that the colour is communicated to the urine by the phæoretine and erythretine, and not by the chrysophanic acid, which, when pure, neither operates on the bowels nor colours the urine. Urine coloured by rhubarb stains the linen, and is reddened by caustic potash.

The cutaneous secretion (especially of the arm-pits) also becomes coloured under the use of rhubarb. The milk of nurses who have taken it is said to acquire a purgative property.

Rhubarb has for a long period been considered to possess a specific influence over the liver, to promote the secretion of bile, and to be used in jaundice. These opinions, which, as Dr. Cullen² correctly observed, have no foundation either in theory or practice, arose from the absurd doctrine of signatures.

Considered in relation to other medicinal agents, rhubarb holds an intermediate rank between the bitter tonics on the one hand, and the drastics on the other. From the first it is distinguished by its purgative qualities; from the latter, by its tonic operation and the mildness of its evacuant effects. As a purgative, it is perhaps more closely allied to aloes than to any other cathartic in ordinary use; but is distinguished by its much milder operation, and its want of any specific action on the large intestines.

The comparative power of the several kinds of rhubarb has scarcely been ascertained with precision. The remarks above made apply to the Russian and Chinese varieties, whose power is about equal. From experiments made by Dr. Parry, at the Bath Hospital, it appears that the purgative qualities of the English rhubarb are scarcely so strong as those of the Russian and Chinese varieties; but the difference is not great.³ For several years past, English rhubarb has been exclusively employed at the London Hospital; and no complaints have been made respecting its operation. Himalayan rhubarb is, according to Dr. Twining,⁴ almost equal to Russian rhubarb in its purgative effects; but is less aromatic, though more astringent.

USES.—The remedial value of rhubarb depends on the mildness and safety of its operation, and on its tonic and astringent influence over the alimentary canal.

1. *As a purgative.*—There are many cases in which the above-mentioned qualities render rhubarb peculiarly valuable as a purgative. In mild cases of *diarrhœa* it sometimes proves peculiarly efficacious, by first evacuating any irritating matter contained in the bowels, and afterwards acting as an astringent. Given at the commencement of the disease, it is a very popular remedy; and though doubtless it is often employed unnecessarily (since, as Dr. Cullen has justly observed, in many cases no further evacuation is necessary or proper, than what is occasioned by the disease), yet it rarely, if ever, does harm. Sulphate of potash is a very useful adjunct to it, and promotes its purgative operation. Antacids (as chalk or magnesia) are frequently conjoined with it. It is not fitted for inflammatory or febrile cases. As an *infant's purgative* it is deservedly celebrated. It is well adapted for a variety of children's complaints; but is peculiarly adapted to scrofulous subjects, and those afflicted with enlargement of the mesenteric glands, accompanied

¹ *Pharmaceutical Journal*, vol. viii. p. 190, 1818.

² Stephenson and Churchill. *Med. Bot.*

³ *Trans. Med. and Phys. Soc. of Calcutta*, vol. iii. p. 441.

⁴ *Mat. Med.*

with tumid belly and atrophy. Magnesia, sulphate of potash, or calomel may be associated with it, according to circumstances. *For an ordinary purgative in habitual costiveness* it is scarcely adapted, on account of the constipation which follows its purgative effect.

2. *As a stomachic and tonic.*—In *dyspepsia*, accompanied with a debilitated condition of the digestive organs, small doses of rhubarb sometimes prove beneficial, by promoting the appetite and assisting the digestive process. In *scrofulous* enlargement of the lymphatic glands, in children, rhubarb, in small doses, is often combined with mercurial alteratives (as the *hydrargyrum cum cretâ*), or with antacids (as magnesia or chalk), and frequently with apparent advantage.

3. *As an external application.*—Sir Everard Home¹ used it as a topical application to promote the healing of indolent non-painful ulcers. The powder is to be lightly strowed over the ulcer, and a compress applied. In irritable ulcers an eighth part of opium is to be added. When applied to large ulcers it has produced pretty active purging.² The powder of rhubarb, incorporated with saliva and rubbed on the abdomen, proves purgative.³

ADMINISTRATION.—The powder of Russian or China rhubarb may be exhibited, as a stomachic and tonic, in doses of from five to ten grains; as a purgative, from a scruple to a drachm. The dose of indigenous rhubarb should be about twice as much as the above.

“By roasting it with a gentle heat, till it becomes friable [*rheum torrefactum*], its cathartic power is diminished, and its astringency supposed to be increased,” (Lewis.)

1. **INFUSUM RHEI**, L. E. D. [U. S.]; *Infusion of Rhubarb*.—(Rhubarb, sliced [in coarse powder, E.], ʒiij [ʒj, E.; ʒij, D.]; Boiling [distilled, L.] Water Oj [ʒix, D.; fʒxviiij, E.]; [Spirit of Cinnamon fʒij, E.]. Macerate for two [one hour, D.] hours in a lightly-covered vessel, and strain [through linen or calico, E.].—[The product should measure about eight ounces, D.] [The U. S. Pharm. directs Rhubarb, bruised, ʒi; Boiling Water Oss. Digest for two hours in a covered vessel, and strain.] Boiling water extracts from rhubarb chrysophanic acid, resin, tannin, gallic acid, sugar, extractive, and starch. As the liquor cools, it becomes turbid. Infusion of rhubarb is stomachic and gently purgative. It is usually employed as an adjunct to, or vehicle for, other mild purgatives or tonics. The alkalis or magnesia are sometimes conjoined. The stronger acids, and most metallic solutions, are incompatible with it. Dose, fʒj to fʒij.

2. **TINCTURA RHEI**, E. [U. S.]; *Tincture of Rhubarb*.—(Rhubarb, in moderately fine powder, ʒiijss [ʒiij, U. S.]; Cardamom Seeds, bruised, ʒss; Proof Spirit [Diluted Alcohol, U. S.] Oij. Mix the rhubarb and cardamom seeds, and proceed by the process of percolation, as directed for tincture of cinchona. This tincture may also be prepared by digestion.)—The alcoholic tincture of rhubarb contains chrysophanic acid, tannin, resin, and uncrystallizable sugar. Cordial, stomachic, and mildly purgative. Dose, as a stomachic, fʒj to fʒij; as a purgative, fʒss to fʒj.

3. **TINCTURA RHEI COMPOSITA**, L. D.; *Compound Tincture of Rhubarb*.—(Rhubarb, sliced, ʒijss [ʒij, D.]; Liquorice, bruised, ʒvi [ʒss, D.]; Saffron ʒij [ʒij, D.]; [Ginger, bruised, ʒij, L.; Cardamom Seeds ʒi, D.]; Proof Spirit Oij. Macerate for seven [fourteen, D.] days, then express and strain.)—Cordial, stimulant, stomachic, and mildly purgative. A popular remedy in various disordered conditions of the alimentary canal, especially at the commencement of diarrhœa, also in flatulent colic. It is a very useful adjunct to purgative mixtures, in cases in which the use of a cordial and stomachic cathartic is required. Dose, as a stomachic, fʒj to fʒij; as a purgative, fʒss to fʒjss.

¹ *Pract. Observ. on the Treatment of Ulcers*, p. 96, 1801.

² Arneimann, *Chirurg. Arzneim.* 6ste Aufl. S. 224.

³ Alibert, *Nouv. Elém. de Thérap.* t. ii. p. 275, et seq. 5me. éd.

4. *TINCTURA RHEI ET ALOES*, E. [U. S.]; *Tincture of Rhubarb and Aloes*.—(Rhubarb, in moderately fine powder, \mathfrak{z} ss; Socotrine or East Indian Aloes, in moderately fine powder, \mathfrak{z} vj; Cardamom Seeds, bruised, \mathfrak{z} v; Proof Spirit Oij. Mix the powders, and proceed as for the tincture of cinchona.)—[The *U. S. Pharm.* directs Rhubarb, bruised, \mathfrak{z} x; Aloes, in powder, \mathfrak{z} vi; Cardamom, bruised, \mathfrak{z} ss; Diluted Alcohol Oij. Macerate for fourteen days, express, and filter through paper.] A cordial and stomachic purgative, in doses of from $\mathfrak{f}\mathfrak{z}$ ss to $\mathfrak{f}\mathfrak{z}$ j.

5. *TINCTURA RHEI ET GENTIANÆ*, E. [U. S.]; *Tincture of Rhubarb and Gentian*.—(Rhubarb, in moderately fine powder, \mathfrak{z} ij; Gentian, finely cut or in coarse powder, \mathfrak{z} ss; Proof Spirit [Diluted Alcohol, *U. S.*] Oij. Mix the powders, and proceed as directed for tincture of cinchona.)—Stomachic. tonic, and feebly purgative. Dose, as a tonic, $\mathfrak{f}\mathfrak{z}$ j to $\mathfrak{f}\mathfrak{z}$ ijj; as a very mild purgative, $\mathfrak{f}\mathfrak{z}$ ss to $\mathfrak{f}\mathfrak{z}$ j.

6. *VINUM RHEI*, E. D. [U. S.]; *Wine of Rhubarb*.—(Rhubarb, in coarse powder, \mathfrak{z} v [\mathfrak{z} ijj, *D.*]; Canella, in coarse powder, \mathfrak{z} ij [Proof Spirit $\mathfrak{f}\mathfrak{z}$ v, *E.*]; Sherry Oj and $\mathfrak{f}\mathfrak{z}$ xv [Oij, *D.*]. Digest for seven days, strain, express strongly the residuum, and filter the liquors.)—[Rhubarb, bruised, \mathfrak{z} ij; Canella, bruised, \mathfrak{z} j; Diluted Alcohol $\mathfrak{f}\mathfrak{z}$ ij; Wine Oj. Macerate for fourteen days, with occasional agitation, then express and filter through paper, *U. S.*]—Cordial, stomachic, and mildly purgative. Used in the same cases as the *compound tincture of rhubarb*. Dose, as a stomachic, $\mathfrak{f}\mathfrak{z}$ j to $\mathfrak{f}\mathfrak{z}$ ijj; as a purgative, $\mathfrak{f}\mathfrak{z}$ ss to $\mathfrak{f}\mathfrak{z}$ j.

7. *EXTRACTUM RHEI*, L. E. D. [U. S.]; *Extract of Rhubarb*.—(Rhubarb, powdered, \mathfrak{z} xv; Proof Spirit Oj; Distilled Water Ovij. Macerate for four days with a gentle heat, afterwards strain, and set by, that the dregs may subside. Pour off the liquor, and evaporate it, when strained to a proper consistence, *L.*—The process of the *Edinburgh and Dublin Colleges* is as follows: Take of Rhubarb \mathfrak{lb} j; Water Ov. Cut the rhubarb into small fragments; macerate it for twenty-four hours in three pints of the water, filter the liquor through a cloth, and express it with the hands or otherwise moderately; macerate the residuum with the rest of the water for twelve hours at least; filter the liquor with the same cloth as before, and express the residuum strongly. The liquors, filtered again, if necessary, are then to be evaporated together to a proper consistence in a vapour-bath. The extract, however, is obtained of finer quality by evaporation in a vacuum with a gentle heat.)—[The *U. S. Pharm.* directs Rhubarb, in coarse powder, \mathfrak{lb} j; Diluted Alcohol a sufficient quantity. Mix the Rhubarb with an equal bulk of coarse sand, moisten it thoroughly with Diluted Alcohol, and having allowed it to stand for twenty-four hours, put it into a percolator, and add Diluted Alcohol gradually until four pints of filtered liquor are obtained; then, by means of a water-bath, evaporate to the proper consistence.]

The *Edinburgh and Dublin Colleges*, it will be observed, employ no spirit in the above process. Great care is required in the preparation of this extract, as both the purgative and tonic properties of rhubarb are very apt to become deteriorated by the process. I have some extract prepared *in vacuo* more than twenty years ago, which still preserves the proper odour and flavour of rhubarb. The dose of extract of rhubarb, as a purgative, is from grs. x to \mathfrak{z} ss.

[8. *EXTRACTUM RHEI FLUIDUM*, U. S.; *Fluid Extract of Rhubarb*.—(Take of Rhubarb, in coarse powder, \mathfrak{z} vijj; Sugar \mathfrak{z} v; Tincture of Ginger \mathfrak{z} ss; Oil of Fennel, Oil of Anise, each miv; Diluted Alcohol a sufficient quantity. To the Rhubarb, previously mixed with an equal bulk of coarse sand, add twelve fluidounces of Diluted Alcohol, and allow the mixture to stand for twenty-four hours. Transfer the mass to a percolator, and gradually pour upon it Diluted Alcohol until the liquid which passes has little of the odour or taste of the rhubarb. Evaporate the tincture thus obtained, by means of a water-bath, to five fluidounces; then add the sugar, and after it is dissolved, mix thoroughly with the resulting fluid extract, the tincture of ginger holding the oils in solution.—This is an excellent and efficient preparation

in doses of fʒi—ij. It may be given to children in small doses. By addition to magnesia it constitutes an effective combination.]

9. PILULÆ RHEI, E. [U. S.]; *Rhubarb Pills*.—(Rhubarb, in fine powder, *nine parts*; Acetate of Potash *one part*; Conserve of Red Roses *five parts*. Beat them into a proper mass, and divide it into five-grain pills.)—[Rhubarb, powdered, ʒvj; Soap ʒij. Make a mass with water, and divide into 120 pills. The soap renders them antacid, U. S.]—Stomachic and purgative. The acetate of potash is employed, I presume, to prevent the pills becoming hard by keeping. Each pill contains nearly three and a half grains of rhubarb.

10. PILULA RHEI COMPOSITÆ, L. E. [U. S.]; *Pilulæ Rhei Compositæ*, D.; *Compound Pills of Rhubarb*.—(Rhubarb, powdered, ʒiv [*twelve parts*, E.]; Aloes, powdered, ʒij [*nine parts*, E.]; Myrrh, powdered, ʒij [*six parts*, E.]; Soap ʒss [*six parts*, E.]; [Oil of Caraway m̄xv, L., Oil of Peppermint *one part*, E.]; Treacle, q. s. [Conserve of Red Roses *five parts*, E.]. Mix them, and beat them into a proper mass [and divide this into five-grain pills. [The U. S. Pharm. directs Rhubarb, in powder, ʒi; Aloes, in powder, ʒvj; Myrrh, in powder, ʒss; Oil of Peppermint fʒss. Beat them with water so as to form a mass, to be divided into two hundred and forty pills.] This pill may be also made without oil of peppermint, when so preferred, E. The *Dublin College* orders of Rhubarb, in fine powder, ʒiss; Hepatic Aloes, in fine powder, ʒix; Myrrh, in fine powder, Castile Soap, of each, ʒvi; Oil of Peppermint fʒi; Treacle, by weight, ʒij.]—Tonic and mildly purgative. Dose, ʒj, or two to four pills.

11. PILULÆ RHEI ET FERRI, E.; *Pills of Rhubarb and Iron*.—(Dried Sulphate of Iron *four parts*; Extract of Rhubarb *ten parts*; Conserve of Red Roses about *five parts*. Beat them into a proper pill mass, and divide into five-grain pills.)—Tonic. Dose, two to four pills.

12. PULVIS RHEI COMPOSITUS, E. D.; *Compound Powder of Rhubarb*.—(Magnesia, lbj [ʒvi, D.]; Ginger, in fine powder, ʒij [ʒi, D.]; Rhubarb, in fine powder, ʒiv [ʒij, D.]. Mix them thoroughly, and preserve the powder in well-closed bottles.)—A very useful antacid and mild stomachic purgative, especially adapted for children. Dose, for adults, ʒj to ʒss; for children, gr. v to gr. x.

[13. SYRUPUS RHEI, U. S.; *Syrup of Rhubarb*.—(Take of Rhubarb, bruised, two ounces; Boiling Water a pint; Sugar two pounds. Macerate the rhubarb in the water for twenty-four hours and strain; then add the sugar, and proceed in the manner directed for syrup.)—This is a mild astringent and laxative, and may be used in bowel affections. The dose is from fʒj to fʒj.

14. SYRUPUS RHEI AROMATICUS, U. S.; *Aromatic Syrup of Rhubarb*; *Spiced Syrup of Rhubarb*.—(Take of Rhubarb, bruised, two ounces and a half; Cloves, bruised, Cinnamon, bruised, each half an ounce; Nutmeg, bruised, two drachms; Diluted Alcohol two pints; Syrup six pints. Macerate the rhubarb and aromatics in the diluted alcohol for fourteen days, and strain; then, by means of a water-bath, evaporate the liquor to a pint, and, while it is still hot, mix it with the syrup previously heated; or it may be made by displacement.)—This syrup is cordial, carminative, and slightly laxative. It is well adapted to weak and relaxed conditions of the bowels, as in chronic diarrhoea, dysentery, and infantile bowel complaints, with feeble action. The dose is fʒj to fʒss.]

151. RUMEX ACETOSA, Linn.—COMMON SORREL.

Sex. Syst. Hexandria, Trigynia.

(Folia.)

HISTORY.—Dioscorides¹ mentions this as the fourth sort (τέταρτον εἶδος) of λάπαθον, which some call ὀξάλις.

¹ Lib. ii. cap. 140.

BOTANY. **Gen. Char.**—*Sepals* 6, the 3 inner (petals) larger, subsequently becoming enlarged (enlarged or permanent petals), converging, and finally concealing the nut. *Stamens* 6. *Stigmas* in many fine tufted segments. *Embryo* lateral.

Sp. Char.—*Leaves* oblong, sagittate or hastate, veiny. *Flowers* diœcious. *Inner sepals* (petals) roundish, cordate, with a very minute tubercle at the base.

Hab.—Indigenous. Woods and pastures common. Perennial. Flowers in June.

DESCRIPTION.—Sorrel leaves have an agreeable, acid, slightly astringent taste.

COMPOSITION.—I am unacquainted with any analysis of this plant. The leaves are composed of *supercarbonate of potash*, *tartaric acid*, *mucilage*, *fecula*, *chlorophylle*, *tannic acid*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Slightly nutritive. Refrigerant and diuretic. Esteemed antiscorbutic.

USES.—Employed as a pot-herb and salad—from the latter use of it, it has been termed *green-sauce*.¹ Rarely applied medicinally. A decoction of the leaves may be administered in whey, as a cooling and pleasant drink, in febrile and inflammatory diseases. In some parts of Scandinavia bread is made of it in times of scarcity.² But the use of aliments containing oxalic acid may, as suggested by Laugier, under some circumstances, dispose to the formation of mulberry calculi.

152. RUMEX HYDROLAPATHUM, *Hudson*.—GREAT WATER DOCK.

Rumex aquaticus, *D.*

Sex. Syst. Hexandria, Trigynia.

(Radix.)

HISTORY.—This is not the *R. aquaticus* of Linnæus.

BOTANY. **Gen. Char.**—See *Rumex Acetosa*.

Sp. Char.—*Inner sepals* (petals) ovate-triangular, entire or slightly toothed, all tubercled. *Racemes* panicle, leafless. *Leaves* lanceolate, narrowed at the base; petiole flat on the upper side.—Stem 3—5 feet high. Leaves often more than a foot long.

Hab.—Indigenous. Ditches and river sides. Perennial. Flowers in July and August.

DESCRIPTION.—The herb and root were formerly used under the name of *herba et radix britannicæ*. The root is inodorous, but has an acrid bitter taste. The flowers are called, by Pliny,³ *ribones*.

COMPOSITION.—I am unacquainted with any analysis of the plant. The root contains *tannic acid*.

PHYSIOLOGICAL EFFECTS.—The root is astringent, and is reputed antiscorbutic.

USES.—Scarcely employed. Has been exhibited internally in scurvy, skin diseases, and rheumatism. The powdered root has been used as a dentifrice; the decoction of the root as an astringent gargle for ulcerated or spongy gums. The druids entertained a superstitious veneration for this plant.

153. POLYGONUM BISTORTA, *Linn*.—GREAT BISTORT OR SNAKE-WEED.

Sex. Syst. Octandria, Trigynia.

(Radix.)

HISTORY.—It is doubtful by whom this plant is first mentioned. It was certainly noticed by the herbalists of the 16th century.

¹ Withering, *Bot.* vol. ii.

² Clarke, *Travels in Scandinavia*, Part III. S. ii. p. 90, 1823.

³ *Hist. Nat.* lib. xxv. cap. vi. ed. Valp.

BOTANY. Gen. Char.—*Calyx* 4—5-cleft, more or less coloured. *Stamens* 5—8, in 2 rows, generally with glands at the base. *Styles* 2—3, more or less united at the base. *Nut* 1-seeded, lenticular or 3-cornered, inclosed by the calyx. *Embryo* lateral, incurved; cotyledons not contorted.

Sp. Char.—*Stem* simple. *Leaves* oblong-ovate, somewhat cordate and wavy; petioles winged. *Spike* dense, terminal.—*Flowers* flesh-coloured. *Stem* 1—1½ foot high.

Hab.—Indigenous. Meadows. Perennial. Flowers in June.

DESCRIPTION.—Bistort root (*radix bistortæ*) is twice bent on itself—hence its name, from *bis*, twice; and *torta*, twisted or bent. It is rugous and brown externally; reddish internally; almost inodorous; it has an austere, strongly astringent taste.

COMPOSITION.—This root has not been analyzed. The principal constituents are *tannic acid*, *starch*, *oxalate of lime*, *colouring matter*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—The local effect is that of a powerful astringent, depending on the tannic acid which it contains; its remote effects are those of a tonic (see vol. i. p. 243). The presence of starch renders the root nutritive—hence in Siberia it is roasted and eaten.

USES.—It is but little employed. A decoction of the root is sometimes employed as an astringent injection in leucorrhœa and gleet; as a gargle in spongy gums and relaxed sore-throat; and as a lotion to ulcers attended with a profuse discharge.

Internally it has been employed, in combination with gentian, in intermittents. It has also been used as an astringent in passive hemorrhages and chronic alvine fluxes.

ADMINISTRATION.—The dose of the powder is from ℥j to ℥ss. The *decoction* (prepared by boiling ℥ij of the root in Ojss of boiling water) may be administered in doses of from f℥j to f℥ij.

ORDER XXXIX. SALSOLACEÆ, Moquin.—SALTWORKS.

ATRIPLICES, Jussieu.—**CHENOPODEÆ, R. Brown.**—**CHENOPODIACEÆ, Lindl.**

CHARACTERS.—*Calyx* deeply divided, persistent, with an imbricated æstivation. *Corolla* 0. *Stamens* usually inserted into the receptacle or base of the calyx, opposite the segments of the latter, and equal to them in number or fewer. *Staminodia* (squamulæ hypogynæ) in a few genera, very minute, alternate between the filaments and with the segments of the calyx. *Ovary* single, superior, or occasionally adhering to the tube of the calyx, with a single amphitropal ovule attached to the base of the cavity; *style* in 2 or 4 divisions, rarely simple; *stigmas* undivided. *Fruit* membranous, utricle, sometimes a caryopsis, rarely a berry. *Seed* with or without farinaceous albumen; *embryo* curved or annular (*cyclobœa*), or in a flat spiral (*spirolobœa*).—*Herbs* or *under-shrubs* sometimes jointed. *Leaves* usually alternate, without stipules. *Flowers* very small, regular, hermaphrodite or sometimes by abortion unisexual. (From Lindley chiefly.)

PROPERTIES.—The plants of this family are characterized by the large quantity of alkali which they contain, and which is combined with an organic acid. Those which inhabit salt marshes are called *halophytes* (from ἅλς, salt, and φυτόν, a plant), and by combustion yield *barilla* (see vol. i. p. 514). Those in most common use for this purpose belong to the genera *Salsola*, *Salicornia*, and *Chenopodium*.

Many of the plants are esculent, and some of them are used as pot-herbs or salads; as spinach (*Spinacia oleracea*) and beet (*Beta vulgaris*). The latter is extensively cultivated and employed as a source of sugar; and a variety of it, called Mangold-Wurzel, is used for feeding cattle. The seeds of *Chenopodium Quinoa* are employed in Peru as food, under the name of *petty rice*; their starch grains are the smallest known.

Volatile oil is found in several, which owe their aromatic, carminative, stimulant, and anthelmintic properties to it.

[154. *Chenopodium Anthelminticum*, Linnaeus.

Sex. Syst. Pentandria, Digynia.

(CHENOPODIUM, U. S. Wormseed. The fruit of the plant.)

Gen. Char.—*Calyx* five-parted, with five angles. *Corolla* none. *Style* bifid, rarely trifid. *Seed* one, lenticular, horizontal, covered by the closing calyx. (Nuttall.)

Sp. Char.—*Leaves* oblong, lanceolate, sinuate, and dentate, rugose. *Racemes* naked. *Style* one, three-cleft (Elliot).

The common names by which this plant is known in the United States are Jerusalem Oak, Wormseed, Goosefoot, and Stinkweed.

DESCRIPTION.—The root of the plant is perennial and branched. Stem upright, herbaceous, much branched, deeply grooved, from two to four feet high. Branches fastigiate, giving to the plant a shrubby appearance. Leaves sessile, scattered, and alternate, attenuate at each end, with strongly marked nervures, oval or oblong, deeply sinuate, studded beneath with small globular, oleaginous dots. Flowers small, numerous, of a yellowish-green colour, and collected in long, axillary, dense, leafless spikes.

Hab.—This species of *Chenopodium* is found in most parts of the United States. It grows in old fields, along roadsides, in moist and sandy situations. It flowers in June and July; and from August until cold weather the seeds may be collected.

The seeds are small, not larger than the head of a common-sized pin, irregularly spherical, very light, of a dull greenish-yellow colour, approaching to brown, and having a bitterish, somewhat aromatic, pungent taste. The odour and taste are due to the volatile oil that they contain; this is found in other parts; in fact, the whole plant contains it, and hence the uniform flavour possessed by them.

The properties of the seeds are vermifuge, which appears to have been known soon after the establishment of the British Colonies in America, especially in Virginia, where they were first used for this purpose. The herb is spoken of by Schoepf and Kalm, with others, in terms of commendation. The vermifuge power, by long trial, has been decidedly proved. As an antispasmodic it has also been used. Plenck employed it with success in five or six cases of chorea (Griffith, *On Chen. Anthel. in Am. Journ. of Pharmacy*, vol. v. p. 180), and this success has been confirmed by other writers.

The *Chenopodium anthelminticum* has sometimes been confounded with the *C. ambrosioides*, which is a smaller plant, and distinguished by the leafy spikes of flowers. The sensible properties are similar.

The seeds are given in the form of an electuary, pulverized and mixed with molasses or syrup; but the quantity required to be taken is liable to produce nausea and sickness. Dose ʒj to ʒij given twice or thrice daily.

The expressed juice is sometimes administered; the dose is ʒss; or a decoction of the leaves may be employed; this is best prepared with milk, in the proportion of ʒj leaves to Oj of milk or water. It may be flavoured with aromatics.

OLEUM CHENOPODII, U. S.; Oil of Wormseed.—This oil is of a light yellow colour when distilled, but its colour deepens by age and exposure. It has in a high degree the flavour of the plant. Its sp. gr. is 0.908. It is obtained by distilling the seeds; but the whole plant may be used for this purpose, as the oil is abundant in the glands. Sometimes it is adulterated with spirit of turpentine, or other inferior volatile oils; this must be determined by the odour. From the readiness with which it may be given, it is the best for exhibition, as it possesses the vermifuge properties in the smallest possible compass. The dose is from 10 to 20 drops on a lump of sugar, or in emulsion. After several doses have been given, a purgative, as castor-oil, may be interposed.—J. C.]

155. *Chenopodium Vulvaria*, Linn.—Stinking Orache.

Sex. Syst. Pentandria, Digynia.

(Herba.)

Chenopodium olidum, Smith, Eng. Flora. *Atriplex fatida*, Cullen, Mat. Med. vol. ii. p. 365. *Stinking Goosefoot*. Indigenous. Cultivated at Mitcham. Sold in the herb-shops as a popular emmenagogue and "strengtheners of the womb." In the fresh state it has a nauseous taste, and a strong offensive odour like that of putrid fish. By drying, it loses its smell, and probably its medicinal qualities also. Dr. Houlton and Mr. Churchill¹ declare that the popular notion of its emmenagogue powers is well founded. Dr. Cullen regarded it as a powerful antispasmodic in hysteria. The recent plant has been used in the form of infusion or tea, and conserve. Mr. Churchill gave the inspissated juice or extract in doses of from five to fifteen grains.

CHENOPODIUM AMBROSIODES, Linn., is said to be used indiscriminately with the preceding. Its odour is weaker and less offensive.

CHENOPODIUM BOTRYS, Linn., is also esteemed anthelmintic.

SUBDIVISION II. COROLLIFLORÆ, De Cund.

MONOPETALÆ COROLLA HYPOGYNA, Juss., ET COROLLA PERIGYNA (partim).

GAMOPETALÆ, Endl. (partim).

Calyx gamosepalous, i. e. sepals more or less united at the base. *Petals mostly united*, distinct at the base from the calyx. *Stamens usually adnate to the corolla*. *Ovary mostly free*, rarely adnate to the calyx.

ORDER XL. LABIATÆ, Jussieu.—LABIATES.

LAMIACEÆ, Lindley.

CHARACTERS.—*Calyx* tubular, inferior, persistent, the odd tooth being next the axis; regular 5- or 10-toothed, or irregular bilabiate or 3- to 10-toothed. *Corolla* monopetalous, hypogynous, bilabiate; the upper lip undivided or bifid, overlapping the lower, which is larger and 3-lobed. *Stamens* 4, didynamous, inserted upon the corolla, alternately with the lobes of the lower lip, the 2 upper sometimes wanting; anthers 2-celled; sometimes apparently unilocular in consequence of the confluence of the cells at the apex; sometimes one cell altogether obsolete, or the 2 cells separated by a bifurcation of the connective. *Ovary* deeply 4-lobed, seated in a fleshy hypogynous disk; the lobes each containing 1 erect ovule; *style* 1, proceeding from the base of the lobes of the ovary; *stigma* bifid, usually acute. *Fruit*, 1 to 4 small nuts, inclosed within the persistent calyx. *Seeds* erect, with little or no albumen; *embryo* erect; *cotyledons* flat. *Herbaceous* plants or *undershrubs*. *Stem* 4-cornered, with opposite ramifications. *Leaves* opposite, divided or undivided, without stipules, replete with receptacles of aromatic oil. *Flowers* in opposite, nearly sessile, axillary cymes, resembling whorls; sometimes solitary, or as if capitate (Lindley).

Fig. 305.



Bilabiate flower.

PROPERTIES.—The medicinal activity of the plants of this family depends on volatile oil, bitter extractive, and astringent matter.

The *volatile oil* resides in small receptacles (by some called *globular glands*) contained in the leaves. "These glands are placed quite superficially, or rather in depressed points, and are commonly of a shining yellow colour. We may regard them as oleo-resinous matter separated from glands lying on the under surface. When macerated in strong spirit of wine they remain unchanged, and appear under the microscope as transparent, probably cellular, vesicles, filled with a yellow granular matter."²

The *bitter extractive* is found, in a greater or less quantity, in all the Labiatæ. It is this principle which communicates the bitterness to the watery infusion of these plants.

The presence of *astringent matter* is shown by the green colour produced when a ferruginous salt is added to the infusion of some of the Labiatæ.

The *volatile oil* gives to these plants aromatic, carminative, and slightly stimulant properties. The bitter extractive renders them tonic and stomachic. The astringent matter is usually in

¹ Stephenson and Churchill's *Medical Botany*, vol. iv. pl. clxxvi. 1831.

² Nees and Ebermaier, *Handb. Med.-Pharm. Bot.* Th. i. S. 524.

too small a quantity to communicate much medicinal activity, though it must contribute to the tonic operation.

The perfumer uses some labiate plants on account of their fragrant odour; the cook employs others for their flavour and condimentary properties; the medical practitioner administers them to relieve nausea and colicky pains, to expel wind, to cover the taste of nauseous medicines, and to prevent or relieve griping pains.

The following species, enumerated by London,¹ are cultivated in this country as *sweet herbs*: Common or Garden Thyme (*Thymus vulgaris*, Linn.), Lemon Thyme (*T. citriodorus*, Schreb.), Sage (*Salvia officinalis*, Linn.), Clary (*S. Sclarea*, Linn.), Peppermint (*Mentha piperita*, Linn.), Spearmint (*M. viridis*, Linn.), Pennyroyal (*M. Pulegium*), Common Marjoram (*Origanum vulgare*, Linn.), Winter Sweet Marjoram (*O. heracleoticum*, Linn.), Sweet Marjoram (*Majorana hortensis*, Mœnch.), Pot Marjoram (*M. Onites*, Benth.), Winter Savory (*Satureja montana*, Linn.), Summer Savory (*S. hortensis*, Linn.), Sweet or Larger Basil (*Ocimum Basilicum*, Linn.), Bush or Least Basil (*O. minimum*, Linn.), Rosemary (*Rosmarinus officinalis*, Linn.), and Garden Lavender (*Lavandula vera*, De Cand.). Some of these species have been, or are, used in medicine, and several of them are official.

Besides the labiate plants contained in the British pharmacopœias and to be noticed, a considerable number of other species have been at different times introduced into medicinal use. Some of these are deficient in volatile oil, but abound in a bitter principle, on which account they have been employed as stomachics and tonics; such are Water Germander (*Teucrium Scordium*, Linn.), Wall Germander (*T. Chamædrys*, Linn.), and Ground Pine (*Ajuga Chamapitys*, Smith); the two last of which have been used, as I have before mentioned, as anti-arthritic remedies (see *ante*, p. 387). Others abound in essential oil, and are consequently more aromatic, stimulant, and carminative; such are Cat-Thyme (*Teucrium Marum*, Linn.), Common Hyssop (*Hyssopus officinalis*, Linn.), Dittany of Crete (*Amarucus Dictamnus*, Benth.), &c. *Teucrium Polium* has been used in diarrhœa, dysentery, and cholera.

TRIBE I. OCIMOIDEÆ, *Benth.*

Stamens bent downwards.

156. LAVANDULA VERA, *De Cand.*—COMMON OR GARDEN LAVENDER.

Lavandula angustifolia, *Ekrenberg.* *L. spica*, var. *α*, Linn.

Sex. Syst. Didynamia, Gymnospermia.

(Oleum e flore destillatum, *L. D.*—The flowering heads; and volatile oil of ditto, *E.* The flowers, *D.*)

HISTORY.—No plant is mentioned, under the name of Lavender, by Hippocrates, Theophrastus, Dioscorides, or Pliny. It is not improbable, however, that lavender may be alluded to, under some other name, by one or more of these authors; but it is impossible now to identify it with any certainty. Sprengel² declares, on the authority of Hiesychius, that the ἰσχυρὸν of Theophrastus³ is *Lavandula Spica*. The σπικὰς or σπικῆς of Dioscorides,⁴ the *stachas* of Pliny,⁵ is the *L. stachas*, Linn.

BOTANY. *Gen. Char.*—*Calyx* ovate-tubular, nearly equal, 13 or rarely 15-ribbed, shortly 5-toothed, with the 4 lower teeth nearly equal, or the 2 lower narrower; the upper either but little broader than the lateral ones, or expanded into a dilated appendage. *Corolla* with the tube exserted, the throat somewhat dilated, the limb oblique and bilabiate; upper lip 2-lobed; lower 3-lobed; all the divisions nearly equal. *Stamens* 4, inclosed in the tube of the corolla, bent downwards. *Filaments* smooth, distinct, not toothed. *Style* shortly bifid at the apex; the lobes complanate, subconnate. *Disk* concave, with 4 fleshy scales at the margin. *Nuts* smooth, adnate to the scales of the disk (Bentham).

Sp. Char.—*Leaves* oblong-linear or lanceolate, quite entire, when young hoary and revolute at the edges. *Spikes* interrupted. *Whorls* of 6 to 10 flowers. *Floral leaves* rhomboid-ovate, acuminate, membranous, all fertile, the uppermost

¹ *Encycl. of Gardening.*

² *Hist. Plant. lib. vi. cap. 6.*

³ *Hist. Nat. lib. xxvii. cap. 107.*

² *Hist. Rei Herb. t. i. p. 96.*

⁴ *Lib. iii. cap. 31.*

shorter than the calyx. *Bracts* scarcely any (Bentham).—An *undershrub* 1 to 2 feet high. *Flowers* purplish-gray.

Hab.—South of Europe. Extensively cultivated at Mitcham, in Surrey, from which place the London market is chiefly supplied.

LAVENDULA SPICA, De Cand. (*L. latifolia*, Villars) or *French Lavender*, formerly considered as a variety only of the preceding species, is not used in medicine. It is distinguished by its lower habit, white colour, the leaves more congested at the base of the branches, the spike denser and shorter, the floral leaves lanceolate or linear, and the presence of bracts (Bentham). It yields by distillation oil of spike (*oleum spicæ*) sometimes called foreign oil of lavender, or, in order to distinguish it from the oil of *Lavandula Stachas*, the true oil of spike (*oleum spica verum*). This oil is distinguished from the genuine oil of *Lavandula vera* by its darker green colour, and its less grateful odour. It is used by painters on porcelain, and by artists in the preparation of varnishes.

PROPERTIES.—*Lavender flowers* (*flores lavandulæ*) have a bluish-gray colour, a pleasant odour, and a pungent bitter taste. The flowering stems are collected in June or July, dried in the shade, and made up into bundles for sale. A cold infusion of the flowers is deepened in colour (*tannate of iron*) by sesquichloride of iron.

COMPOSITION.—The principal constituents of the flowers are volatile oil, resin (?), tannic acid, a bitter principle, and woody fibre.

PHYSIOLOGICAL EFFECTS.—The flowers are carminative, mildly stimulant, and somewhat tonic. Kraus¹ says that when taken internally they cause griping.

USES.—Lavender flowers are sometimes employed as errhines. They enter into the composition of the *puleis asari compositus* (see ante, p. 387).

1. **OLEUM LAVANDULÆ**, E. D. [U. S.]; *Oleum Lavandulæ* (*Anglicum*), L.; *Oleum Lavandulæ veræ*; *English Oil of Lavender*, offic.—(Prepared by submitting lavender flowers to distillation with water.)—It has a pale yellow colour, a hot taste, and a very fragrant odour. Its sp. gr. varies from 0.877 to 0.905; the lightest oil being the purest. It boils at 397° F.; and is composed, according to Dr. Kane, of C¹⁵H¹⁴O². 1 lb. of oil is obtained from 50 to 70 lbs. of the flowers. 1973 lbs. of the flowers carefully separated from the stalks, yielded Mr. Jacob Bell² at 13 distillations, 28½ lbs. of oil; or 1 lb. of oil from 69½ lbs. of flowers. When the stalks and leaves are distilled with the flowers, the odour of the oil is considerably deteriorated.³ It is a stimulant and stomachic, and is sometimes given in hysteria and headache; but is more commonly employed as a perfume for scenting evaporating lotions, ointments, liniments, &c.—Dose, gtt. ij to gtt. v.

2. **SPIRITUS LAVANDULÆ**, E. [U. S.]; *Spirit of Lavender*.—(Fresh Lavender ñijss; Rectified Spirit Cong. j. Mix them, and, with the heat of a vapour-bath, distil over seven pints. The dried flowers may be substituted for the fresh ones. Druggists frequently prepare this compound by dissolving a few drops of oil of lavender in a fluidounce of rectified spirit. Employed only in the preparation of the *Spiritus Lavandulæ composita*, E.

LAVENDER WATER.—The fragrant perfume sold in the shops, under the name of *lavender water* (*aqua lavandulæ*) is a solution of the oil of lavender and of other odoriferous substances in spirit. It is in fact, therefore, a *compound spirit of lavender*; but this name is already appropriated to another preparation. There are various formulæ for its preparation, scarcely two manufacturers adopting precisely the same one. The following yields a most excellent product: Oil of Lavender, Oil of Bergamot, aa. fñij; Otto of Roses, Oil of Cloves, aa. gtt. vj; Musk gr. ij; Oil of Rosemary fñj; Honey ñj; Benzoic Acid ðij; Rectified Spirit 0j; Distilled Water ñij. Mix, and after standing a sufficient time (the longer the better), filter. This agreeable perfume may be employed for scenting spirit-washes, &c., but is principally consumed for the toilet.

3. **TINCTURA LAVANDULÆ COMPOSITA**, L. D.; *Spiritus Lavandulæ compositus*, E. [U. S.]; *Lavender Drops* or *Red Lavender Drops*, offic.—(Oil of Lavender fñiss [fñij, D.]; Oil of Rosemary m x [fñj, D.]; Cinnamon, bruised, ñijss [ñj, D.]; Nut-

¹ Heilmittel. p. 473.

Brande, *Dict. of Mat. Med.* pp. 387–8; J. Bell, *op. cit.*

² *Pharm. Journal*, vol. v. iii. p. 276, 1845.

meg, bruised, ʒijss [ʒss, *D.*]; [Red Sanders Wood, cut, ʒv, *L.*; Cochineal, in powder, of each ʒij, *D.*]; Rectified Spirit Oij. Macerate the cinnamon, nutmeg, and red sanders wood in the spirit for seven [fourteen, *D.*] days; then express, filter, and to the filtered liquor add the oils, *L.*—Spirit of Lavender Oij; Spirit of Rosemary fʒxij; Cinnamon, in coarse powder, ʒj; Cloves, bruised, ʒij; Nutmeg, bruised, ʒss; Red Sandal Wood, in shavings, ʒijj. Macerate for seven days, and strain the liquor through calico, *E.*)—[The *U. S. Pharm.* directs Spirit of Lavender Oij; Spirit of Rosemary Oj; Cinnamon, bruised, ʒi; Cloves, bruised, ʒij; Nutmeg, bruised, ʒss; Red Sanders, rasped, ʒijj. Macerate for fourteen days and filter through paper.]—Stimulant, cordial, and stomachic. Employed to relieve gastric uneasiness, flatulence, low spirits, languor, faintness, &c. A favourite remedy with hysterical and hypochondriacal persons.—Dose, from fʒss to fʒij, administered in water or on sugar. The red Sanders wood is merely a colouring ingredient.

TRIBE II. SATURIEÆ, *Benth.*

Stamens distant, straight, straggling, or converging under the upper lip, 4 or 2 (in that case the anthers 2-celled and the connective not filiform). Lobes of the *corolla* flat.

157. *Pogostemon Patchouli*, *Pellet.*—Pucha-Pat, or Patchouli.

Sex. Syst. Didynamia, Gymnospermia.

(Herba.)

Patchouly, Virey, Journ. de Pharm. t. xii. p. 61, 1826.—*Puchá Pát*, Wallich, Trans. Med. and Phys. Soc. of Calcutta, 1835.—*Pogostemon intermedius*, Benthani, in Wall. Cat. n. 2327.—*Patchouli* or *Puchá Pát*, Pereira, Pharm. Journ. vol. iv. p. 80, 1844.—*Pogostemon Patchouly*, Pelletier-Santelet, in Mém. de la Soc. Roy. des Sc. d'Orl. tom. v. p. 274, 1845 cum Ic.; also Pharm. Journ. vol. viii. p. 574; Benth. in De Cand. Prodr. t. xii. p. 153.—*Pogostemon sauwis*, Tenore.—*Pogostemon Patchouli*, Hooker, Journ. of Bot. and Kew Gard. Miscell. vol. i. p. 329 c. Ic.

A pubescent undershrub. Branches vague, decumbent or ascending. Leaves with stalks, opposite, rhomboid-ovate, somewhat obtuse; the lobes crenato-dentate. Spikes terminal and axillary, dense, pedunculated, interrupted at the base. Bracts ovate. Calyx hirsute, twice as long as the bracts, with lanceolate teeth. Corolla bilabiate, smooth and whitish. Stamens 4, didynamous, nearly equal in length; the filaments bearded with violet or bluish purple hairs; the anthers pale yellow, after flowering whitish. Style pale purplish, whitish at the lower part, at the apex deeply cleft. Ovaries 4, distinct.—A native of Silhet, Penang, and the Malayan peninsula.

The wild plant is collected at Penang and the Malayan peninsula, and dried in the sun. If too much dried, it becomes crisp and brittle, and is liable to crumble to dust in packing.

The dried tops (*summitates patchouli*) are imported into England in boxes of 110 lbs. each, and in half boxes. They are a foot or more in length. The large stems are round and woody, and, when cut transversely, show the pith surrounded with a thick layer of wood, which is remarkable for its distinct medullary rays; the smaller branches are obscurely 4-angled. The leaves are covered, especially on their inferior surface, with a soft pallid pubescence, which gives the plant a grayish appearance. The odour is strong, persistent, peculiar, and somewhat analogous to that of *Chenopodium anthelminticum*. It is said to smell more strongly in dry than in damp places. One writer describes the smell of it as being dry, mouldy, or earthy; and states that the Chinese or Indian ink owes its characteristic odour to it. The taste of the dried plant is very slight.

The plant, which has not been analyzed, contains *volatile oil*, *green resin*, *extractive matter*, and *tannin*. By distillation it yields about 2 per cent. of volatile oil (*essential oil of patchouli*), which possesses the odour of the herb.

Patchouli is almost exclusively used as a perfume. To its excessive employment, ill effects have been ascribed. "Very recently," says a French writer, "a young lady was seized with a passion for patchouli. Her linen, her dresses, and her furniture, were saturated with it. In a short time she lost her appetite and sleep; her complexion got pale, and she became subject to nervous attacks."² In India, patchouli is used as an ingredient in tobacco for smoking. The *sachets de patchouli* of the perfumers consist of a few grains of the coarsely-powdered herb mixed with cotton wool and folded in paper. Placed in drawers, they are said to drive away

¹ *Annuaire de Thérapeutique* pour 1847, p. 75.

² For some remarks on the sensitiveness of some female constitutions to odorous emanations, see *ante*, vol. i. p. 66.

insects from linen, shawls, &c. Oil of patchouli is in common use in India for imparting the peculiar fragrance of the leaf to clothes among the superior classes of natives. *Esence de patchouli* is used by perfumers principally for mixing with other scents in the preparation of compounded perfumes, for which purpose it is considered very useful.

158. MENTHA VIRIDIS, Linn.—SPEARMINT.

Sex. Syst. Didynamia, Gymnospermia.

(Herba florens recens et exsiccata. Oleum ex herba florente destillatum, L.—Herb, E. D.)

HISTORY.—See *Mentha piperita*.

BOTANY. *Gen. Char.*—*Calyx* campanulate or tubular, 5-toothed, equal or somewhat 2-lipped, with the throat naked inside, or villous. *Corolla* with the tube inclosed, the limb campanulate, nearly equal, 4-cleft; the upper segment broader, nearly entire or emarginate. *Stamens* 4, equal, erect, distinct; *filaments* smooth, naked; *anthers* with two parallel cells. *Style* shortly bifid, with the lobes bearing stigmas at the points. *Nucules* dry, smooth (Bentham).

Sp. Char.—*Stem* erect, smooth. *Leaves* subsessile, ovate-lanceolate, unequally serrated, smooth; those under the flowers all bract-like, rather longer than the whorls; those last and the calyxes hairy or smooth. *Spikes* cylindrical, loose. *Whorls* approximated, or the lowest or all of them distant. Teeth of the *calyx* linear subulate (Bentham).—Creeping-rooted.

Var. *β. angustifolia*, Bentham. Leaves of the branches with short petioles. Distinguished from *M. piperita* by the slender elongated spikes.

Var. *γ. crispa*, Bentham. *Curled Mint*. Cultivated in gardens.

Hab.—Marshy places. Indigenous. A native of the milder parts of Europe; also of Africa and America. Perennial. Flowers in August. Selected for medicinal use when about to flower.

PROPERTIES.—The whole herb, called *green-mint* or *spearmint* (*herba mentha viridis*), is employed in medicine. It has a strong but peculiar odour, and an aromatic, bitter taste, followed by a sense of coldness when air is drawn into the mouth. Sesquichloride of iron communicates a green colour (*tannate of iron*) to the cold watery infusion.

COMPOSITION.—Its odour and aromatic qualities depend on *volatile oil*. It also contains *tannic acid*, *resin* (?), a *bitter principle*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Aromatic, carminative, mildly stimulant and tonic. Feebler than Peppermint. Said, though without sufficient foundation, to check the secretion of milk, and to act as an emmenagogue.¹

USES.—Employed as a salad and sweet herb. In medicine, it is principally used as a flavouring ingredient, and to alleviate or prevent colicky pains. The following are its official preparations, with their uses:—

1. INFUSUM MENTHÆ VIRIDIS, D.; *Infusion of Spearmint*; *Spearmint Tea*.—(Spearmint, dried and cut small, ʒiij; Boiling Water Oss.)—Stomachic and carminative. Used in irritable conditions of the stomach; but is ordinarily a vehicle for other remedies. Dose, fʒj to fʒij, or *ad libitum*.

2. OLEUM MENTHÆ VIRIDIS, L. E. D. [U. S.]; *Oil of Spearmint*.—(Obtained by submitting the fresh herb to distillation with water.)—It is of a pale yellowish colour, but becomes reddish by age. It has the odour and taste of the plant, and is lighter than water; sp. gr. 0.914. It boils at 320° F.; and is composed, according to Dr. Kane, of C³⁵H²⁶O. The average produce of the essential oil is not more than 1-500th of the fresh herb.² It is carminative and stimulant. Dose, gr. ij to gtt. v, rubbed with sugar and a little water.

3. SPIRITUS MENTHÆ VIRIDIS, L.; *Spirit of Spearmint*.—(Oil of Spearmint ʒiij; Proof Spirit Cong. j. Dissolve.) Dose, fʒss to fʒij.—This preparation has no

¹ Linnæus, in Murray's *App. Med.* vol. ii. pp. 180—1.

² Brande, *Dict. Mat. Med.* p. 325.

advantages over, while it is much weaker than, the more simple and elegant preparation, the *essence of spearmint* of the shops.

4. *ESSENTIA MENTHÆ VIRIDIS*, D.; *Essence of Spearmint*.—(Oil of Spearmint fʒj; Stronger Spirit fʒix. Mix with agitation.)—It may be coloured green by spearmint or spinach leaves. Dose, gtt. x to gtt. xx, taken on sugar or in water. [This is the same as the *Tinctura Olei Menthæ Viridis* (*U. S. Pharm.*), for which the formula is, Oil of Spearmint fʒij; Alcohol Oj. Dissolve the oil in the alcohol.]

5. *AQUA MENTHÆ VIRIDIS*, L. E. D. [U. S.]; *Spearmint Water*.—(Spearmint, dried, lbij; Water Oij. Let a gallon distil. If the fresh herb be used, double the weight is to be employed. (The *Edinburgh* process is the same, except that fʒiij of Rectified Spirit is also used.) Or, Oil of Spearmint fʒij; Powdered Flint ʒij; Distilled Water Cong. j. First diligently rub the oil with the flint, afterwards with the water, and strain the liquor, *L.*—Essence of Spearmint fʒj; Distilled Water Cong. ss. Mix with agitation, and filter through paper, *D.*)—Spearmint water is usually made extemporaneously by suspending or dissolving a drachm of the oil in four pints of distilled water, by means of a drachm of rectified spirit and a lump of sugar [or by means of carbonate of magnesia, *U. S.*] (see vol. i. p. 304). Spearmint water is carminative and stomachic. It is commonly used as a vehicle for other medicines. Its dose is fʒj to fʒiij.

159. MENTHA PIPERITA, Linn.—PEPPERMINT.

Sex. Syst. Didynamia, Gymnospermia.

(Herba florens et exsiccata. Oleum ex herba florente destillatum, *L.*—Herb; Volatile oil, *E.*—The herb, *D.*)

HISTORY.—The ancient Greeks¹ employed in medicine a plant which they called *Μίνθος*, or *Μίνθη*, and which, on account of its very agreeable odour, was also termed *ἡδυόσμον*, or the *sweet-smelling herb*. It was probably a species of *Mentha*; and, according to Fraas,² was the *M. piperita*, Linn.; the *ἡδυόσμον περιώδες* of the modern Greek Pharmacopœia.

Peppermint came into use in England in the last century; at least Hill,³ in 1751, says that it “has lately got into great esteem;” and Geiger⁴ says it was introduced into Germany as a medicine, through the recommendations of the English, in the latter half of the last century.

BOTANY. *Gen. Char.*—See *Mentha viridis*.

Sp. Char.—*Stem* smooth. *Leaves* petiolated, ovate-oblong, acute, serrate, rounded-crenate at the base, smooth. *Spikes* lax, obtuse, short, interrupted at the base. *Pedicels* and *calyces* at the base smooth; teeth hispid (Bentham).—Creeping-rooted.

Var. β., subhirsuta, Bentham; *M. hirsuta* δ, Smith. The nerves of the under surface of the leaves, as well as the petioles, hairy.

Hab.—Watery places. Indigenous. Extensively cultivated at Mitcham, in Surrey, from whence the London market is principally supplied. Found in various parts of Europe; also in Asia, Africa, and America.

PROPERTIES.—The whole herb (*herba menthæ piperitæ*) is officinal. It has a peculiar aromatic odour, and a warm, burning, bitter taste, followed by a sensation of coolness when air is drawn into the mouth. Sesquichloride of iron communicates a green colour (*tannate of iron*) to the cold infusion of peppermint.

COMPOSITION.—The principal constituents are *volatile oil*, *resin?* a *bitter principle*, *tannic acid*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Peppermint is an aromatic or carminative, stimulant, and stomachic. It is the most agreeable and powerful of all the mints.

¹ Hippocrates, *De victus rat.* lib. ii. p. 359. ed. Færs.; Dioscorides, lib. iii. cap. 36.

² *Synop. Plant. Fl. Classicæ*, 1845.

³ *Handb. d. Pharm.* Bd. iii. S. 1230.

⁴ *Hist. of the Mat. Med.* p. 358.

USES.—It is employed in medicine for several purposes, but principally to expel flatus, to cover the unpleasant taste of other medicines, to relieve nausea, griping pain, and the flatulent colic of children. The following are the officinal preparations, with their uses:—

1. *OLEUM MENTHÆ PIPERITÆ*, L. E. D.; *Oil of Peppermint*.—(Obtained by submitting the fresh herb to distillation with water.)—It is colourless, or nearly so, sometimes having a pale yellow or greenish tint, and becoming reddish by age. It has a penetrating odour like that of the plant, and a burning aromatic taste, followed by a sensation of cold. The vapour of it applied to the eye causes a feeling of coldness.

Oil of peppermint consists of two isomeric oils—one liquid, the other solid; the latter is called *peppermint-camphor*, or the stearoptene of oil of peppermint. Its composition is $C^{20}H^{30}O^2$. It is in colourless prisms, which have the odour and taste of peppermint, are almost insoluble in water, but readily soluble in alcohol and ether, and are fusible at 92° F. Under the influence of phosphoric acid, peppermint-camphor loses $2H^O$, and becomes a colourless liquid oil, called *menthene* $C^{20}H^{18}$.

I have met with three varieties of oil of peppermint:—

a. *English Oil of Peppermint*.—This is the finest sort. Its sp. gr. is 0.902. It is obtained at Mitcham. In a warm, dry, and favourable season, the produce of oil, from a given quantity of the fresh herb, is double that which it yields in a wet and cold season. The largest produce is three drachms and a half of oil from two pounds of fresh peppermint, and the smallest about a drachm and a half from the same quantity.¹ I was informed by a distiller at Mitcham, that twenty mats of the herb (each mat containing about 1 cwt.) yields about seven lbs of oil.

β. *American Oil of Peppermint*.—In odour and flavour it is inferior to the preceding sort. It is said to be prepared from the dried plant gathered when in flower (Brande). It yields a considerable quantity of camphor.

γ. *China Oil of Peppermint*.—*Po ho yo*.—For a sample of this I am indebted to Dr. Christison. It comes from Canton. It consists chiefly of peppermint-camphor, and forms a white crystalline solid even in summer.

Oil of peppermint is said to be adulterated with oil of rosemary;² the odour would probably serve to distinguish the fraud.

Oil of peppermint is carminative and stimulant, and is used occasionally as an antispasmodic. It is taken on sugar, in doses of from gtt. ii to gtt. v.

2. *SPIRITUS MENTHÆ PIPERITÆ*, L.; *Spiritus Menthæ*, E.; *Spirit of Peppermint*.—(Prepared with the Oil of Peppermint, in the same way as the *Spiritus Mentha viridis*, L., before described. The *Edinburgh College* prepares it thus: Peppermint, fresh, lbss; Proof Spirit Oviij. Macerate for two days in a covered vessel: add a pint and a half of water, and distil off seven pints.)—A solution of the oil of peppermint may with great propriety be substituted for the preparation of the Pharmacopœias. The spirit of peppermint is given in doses of from fʒss to fʒij.

3. *ESSENTIA MENTHÆ PIPERITÆ*, D.; *Essence of Peppermint*.—(Oil of Peppermint fʒi; Stronger Spirit fʒix. Mix with agitation.)—[This is the *Tr. Olei Menthæ Piperitæ*, U. S. The Formula as for Tincture of Oil of Spearmint.] Some persons add peppermint or spinach leaves to communicate a green colour. The dose of this essence is from gtt. xx to gtt. xxx, on sugar.

4. *AQUA MENTHÆ PIPERITÆ*, L. E. D.—(Prepared with the herb or the oil of peppermint, in the same way as the *Aqua Menthæ viridis*.)—Carminative and stimulant. Used to relieve flatulency, and as a vehicle for other medicines. Dose, fʒ. to fʒij.

Besides the above, there are several popular preparations of peppermint extensively used.

a. *Infusum Menthæ piperitæ* (*Peppermint Tea*) is prepared in the same way as spearmint tea.

β. *Elæosaccharum Menthæ piperitæ*, Ph. Bor., is prepared by mixing ʒj of the whitest sugar, in powder, with gtt. xxiv of the oil of peppermint.

γ. *Rotulæ Menthæ piperitæ* (in plano convex masses, called *peppermint drops*—in flattened or

¹ Brande, *Dict. of Mat. Med.* p. 356.

² *Pharmaceutical Journal*, vol. i. p. 263, 1841.

cular disks, termed *peppermint lozenges*) should consist of sugar and oil of peppermint only, though flour is sometimes introduced.

The *liqueur* sold at the spirit-shops as *mint* or *peppermint* is used as a cordial.

160. MENTHA PULEGIUM, Linn.—PENNYROYAL.

Sex. Syst. Didynamia, Gymnospermia.

(Herba florens recens et exsiccata. Oleum ex herba florente destillatum, L.—Herb, E. D.)

HISTORY—This plant was employed in medicine by the ancient Greeks and Romans. It is the *Γαγγάν* of Hippocrates¹ and Dioscorides,² and the *Pulegium* of Pliny.³

BOTANY. *Gen. Char.*—See *Mentha viridis*.

Sp. Char.—*Stem* very much branched, prostrate. *Leaves* petiolated, ovate. *Whorls* all remote, globose, many-flowered. *Calyces* hispid, bilabiate, villous in the inside of the throat (Bentham).—Creeping-rooted.

Hab.—Wet commons and margins of brooks. Indigenous. A native of most parts of Europe, of the Caucasus, Chili, and Teneriffe.

PROPERTIES.—The herb with the flowers (*herba seu summitates pulegii*) is employed in medicine. It has a strong, but peculiar odour; a hot, aromatic, bitter taste, followed by a feeling of coolness in the mouth. Sesquichloride of iron causes a green colour (*tannate of iron*) with the cold infusion of pennyroyal.

COMPOSITION.—Its principal constituents are *volatile oil*, a *bitter matter*, *resin*? *tannic acid*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Its effects are analogous to the other mints. Emmenagogue and antispasmodic properties are ascribed to it by the public, and formerly by medical practitioners.

USES.—A popular remedy for obstructed menstruation, hysterical complaints, and hooping-cough. Rarely employed by the professional man. The following are its official preparations, with their uses:—

1. **OLEUM MENTHÆ PULEGI**, L. E. D.; *Oleum Pulegii*, offic.; *Oil of Pennyroyal*.—(Obtained by submitting the herb to distillation with water.)—It has a pale colour, a warm taste, and the peculiar odour of the herb. It boils at 395° F. Its sp. gr. is 0.925; and is composed, according to Dr. Kane, of C¹⁰H¹⁶O. The fresh herb yields from 1-120th to 1-100th of its weight of oil.⁴ It is stimulant and carminative, and is used, as an antispasmodic and emmenagogue, in doses of from gtt. ij to gtt. v, taken on sugar.

2. **SPIRITUS MENTHÆ PULEGI**, L.; *Spiritus Pulegii*; *Spirit of Pennyroyal*.—(Prepared with Oil of Pennyroyal, as the *Spiritus Menthæ viridis*.)—Usually prepared by dissolving the oil in spirit. Stimulant and carminative. Employed as an antispasmodic and carminative. Dose, fʒss to fʒij.

3. **ESSENTIA MENTHÆ PULEGI**, D.; *Essence of Pennyroyal*.—(Oil of Pennyroyal fʒj; Rectified Spirit fʒix. Mix with agitation, D.)—May be given in doses of from gtt. x to gtt. xx.

4. **AQUA MENTHÆ PULEGI**, L. E. D.; *Aqua Pulegii*, offic.; *Pennyroyal Water*.—(Prepared with the herb or oil, like *Aqua Menthæ viridis*.)—Carminative and stomachic. Dose, fʒj to fʒij.

The liquid sold in the shops as **PENNYROYAL AND HYSTERIC WATER** is prepared by adding fʒss of the compound spirit of bryony to Oss of pennyroyal water.

¹ P. 359, &c. ed. Pærs.

² *Hist. Nat. lib. xx. cap. 51, ed. Valp.*

³ *Lib. iii. cap. 36.*

⁴ *Brande, Dict. Mat. Med. p. 357.*

161. ORIGANUM VULGARE, Linn.—COMMON OR WILD MARJORAM.

Sex. Syst. Didynamia, Gymnospermia.
(Herb, E.—Oleum ex herba.)

HISTORY.—Fraas¹ is of opinion that this plant is the *ὀρίγανον μέλαν* of Theophrastus,² the *ἀγρορίγανος* of Dioscorides.³

BOTANY. *Gen. Char.*—*Calyx* ovate-campanulate, nearly 13-nerved, 5-toothed or 2-lipped, the upper lip entire or 3-toothed, the inferior lip 2-toothed, truncated, or altogether deficient, the calyx being then obcompressed-flat. Tube of the *corolla* inclosed or exserted, the upper lip emarginate or slightly 2-cleft, the lower lip longer, spreading, 3-cleft. *Stamens* 4, ascending or straggling at the apex, or distant at the base; anthers with 6 distinct diverging or straggling cells. Lobes of the *style* acute, the posterior one usually shorter. *Floral leaves* bract-like. *Flowers* in spikes (Bentham).

Sp. Char.—Erect, villous. *Leaves* petiolate, broad-ovate, obtuse, subserrate, broad-rounded at the base, green on both sides. *Spikes* oblong or cylindrical, clustered in corymbose panicles. *Bracts* (floral leaves) ovate, obtuse, coloured, (commonly glandless), half as long again as the calyx (Bentham).—Creeping-rooted. *Flowers* light purple.

Hab.—In bushy places, on a limestone and gravelly soil. Indigenous. A native of several parts of Europe; also of Asia. Flowers in July and August.

PROPERTIES.—The whole herb (*herba origani*) is officinal. It has a peculiar aromatic odour, and a warm pungent taste. Sesquichloride of iron produces a green colour (*tannate of iron*) with the cold infusion of *origanum*.

COMPOSITION.—*Volatile oil*, *resin?* *tannic acid*, *a bitter principle*, and *woody fibre*, are the principal constituents of this plant.

PHYSIOLOGICAL EFFECTS.—Stimulant and carminative, like the other labiate plants.

USES.—Principally employed to yield the volatile oil. The dried leaves have been used as a substitute for China tea.⁴ The infusion of *origanum* has been used in chronic cough, asthma, and amenorrhœa.

OLEUM ORIGANI, E. [U. S.]; *Oil of Common Marjoram.*—(Obtained by submitting the herb to distillation with common water.)—The average produce of essential oil from the herb is one pound from two hundred weight; but it varies exceedingly with the season and culture of the plant.⁵ According to Dr. Kane, its sp. gr. is 0.867, its boiling point 354° F.; and its composition C³⁰H⁴⁰O.

It is a powerful acrid and stimulant; and is applied to carious teeth by means of lint or cotton, to relieve toothache. Mixed with olive oil, it is frequently employed as a stimulating liniment against alopecia or baldness, rheumatic or paralytic affections, sprains, bruises, &c.

The red volatile oil, usually sold in the shops as *oleum origani* or *oil of thyme*, is obtained from *Thymus vulgaris*, and is imported from the south of France (see *Thymus vulgaris*).

162. ORIGANUM MAJORANA, Linn.—SWEET OR KNOTTED MARJORAM.

Majorana hortensis, Manch.
Sex. Syst. Didynamia, Gymnospermia.
(Herba.)

HISTORY.—Fraas⁶ is of opinion that the *ἀμάχον* of Theophrastus,⁷ the *γάμψος*

¹ *Synops. Plant. Fl. Classica*, 1845.

² *Lib. iii. cap. 34.*

³ *Brande, Diet. Mat. Med. p. 401.*

⁴ *Hist. Plant. lib. vii. cap. 7.*

⁵ *Hist. Plant. lib. vi. cap. 2.*

⁶ *Murray, App. Med. vol. ii. p. 173.*

⁷ *Hist. Plant. Fl. Class. p. 163, 1845.*

of Dioscorides,¹ and the *Amaracum* or *Sampsuchum* of Pliny,² are identical with our sweet marjoram.

BOTANY. *Gen. Char.*—See *ante*, p. 448.

Sp. Char.—*Branches* smoothish, racemose-paniculate. *Leaves* petiolate, oblong-ovate, obtuse, quite entire, on both sides hoary-tomentose. *Spikelets* oblong, on sessile crowded branchlets. *Calyx* nearly toothless, cleft anteriorly (Bentham).—*Flowers* purple or white.

Hab.—Africa and Asia. Cultivated in kitchen gardens.

PROPERTIES.—The whole plant (*herba majoranæ*) has a warm aromatic flavour, and a peculiar savoury smell. Its watery infusion is deepened in colour (*tannate of iron*) by sesquichloride of iron.

COMPOSITION.—By distillation the plant yields *volatile oil*. The other constituents are *tannic acid*, *resin?* *bitter matter*, and *woody fibre*.

OIL OF SWEET MARJORAM (*Oleum Majoranæ*) is pale yellow or brownish, with the strong odour and taste of marjoram.

PHYSIOLOGICAL EFFECTS.—Tonic and mild stimulant.

USES.—Principally employed as a sweet herb by the cook. Its powder is sometimes used, either alone or mixed with some other powder, as an errhine. *Marjoram tea* is occasionally employed as a popular remedy for nervous complaints.

163. THYMUS VULGARIS, Linn.—COMMON OR GARDEN THYME.

Sex. Syst. Didynamia, Gymnospermia.
(Herba et Oleum.)

HISTORY.—The true Thyme, *Θύμος* of the ancients, is the *Thymus capitatus*, Hoffm. et Link. (*Satureia capitata*, Linn.)

BOTANY. *Gen. Char.*—*Calyx* ovate, 10—13-nerved, 2-lipped; upper lip 3-toothed, spreading; lower lip 2-cleft, with ciliate, subulate segments; throat villous inside. *Corolla* having the tube inclosed by the calyx or imbricated bracts, naked inside; limb sub-bilabiate; upper lip straight, emarginate, flattish; lower lip spreading, 3-cleft, with equal lobes, or the middle one largest. *Stamens* exserted, or rarely inclosed, straight, distant, nearly equal or didynamous, the lower 2 being the longest. *Anthems* with 2 parallel or at length diverging cells. *Style* about equally bifid at the apex, with subulate lobes (Bentham).

Sp. Char.—Erect or procumbent at the base. *Leaves* sessile, linear, or ovate-lanceolate, acute, with revolute edges, fascicled in the axils. *Bracts* (floral leaves) lanceolate, obtuse. *Whorls* loose, rather distant. *Teeth* of the upper lip of the *calyx* lanceolate; the segments of the lower lip subulate ciliated (Bentham).—Shrub much branched, $\frac{1}{2}$ to 1 foot high, rather hoary with a short down. *Flowers* purplish.

Var. a. latifolius: Broad-leaved Garden Thyme—Cultivated in gardens for culinary purposes.

Var. b. angustifolius: Narrow-leaved Garden Thyme.

A variegated variety is cultivated for ornament. Lemon Thyme, which is cultivated for culinary purposes, is *T. Serpyllum*, var. *vulgaris*, Bentham.

Hab.—South-West of Europe, in dry, arid, uncultivated places. Cultivated as a sweet herb in England.

DESCRIPTION.—The flowering-tops of garden thyme (*herba et summitates thymi*) are dried, and sold in the shops as one of the herbs used for culinary purposes. The odour is fragrant, and to most persons agreeable.

COMPOSITION.—Similar to that of *Origanum vulgare*. The odour and condimentary properties depend on volatile oil (*oleum thymi*).

EFFECTS AND USES.—Similar to the other sweet herbs. Chiefly used by the

¹ Lib. iii. cap. 47.

² Hist. Nat. lib. xxi. cap. 35, ed. Valp.

cook for soups, stuffings, and sauces. In the South of France the herb is used for distillation, to yield the oil of thyme.

OLEUM THYMI; Oil of Thyme.—At Milhaud, Aujargues, Souvignargues, and near the village of Fontanes, as well as at several other places in the neighbourhood of Nismes, in the department of Gard in the South of France, this oil is largely distilled, and is imported into England and sold as *oleum origani*. Mr. Daniel Hanbury, who visited this district in the summer of 1849, tells me that the plant grows spontaneously in abundance on the arid, rocky, waste hills of that neighbourhood. The entire plants, whether in flower or not, are collected, and, either in the fresh or dried state, submitted to distillation with water. The oil, which is of a reddish-brown colour, is called *red oil of thyme* (*huile rouge de thym*), becomes much paler by redistillation, and is then called *white oil of thyme* (*huile blanche de thym*). The specimen of red oil of thyme obtained by Mr. D. Hanbury is identical with the oil sold as *oleum origani* in the London shops, all of which is imported.¹ Specimens of the plant which yields the oil have been examined by Mr. Benthams, Dr. Lindley, and others; and by all have been pronounced undoubtedly *Thymus vulgaris*.

The medicinal properties and uses of oil of thyme are the same as those of the *oleum origani*, for which it is usually employed (see *ante*, p. 448).

164. MELISSA OFFICINALIS, Linn.—COMMON BALM.

Sex. Syst. Didynamia, Gymnospermia.

(Herba, E.)

HISTORY.—Both Smith² and Sprengel³ consider this plant to be the *μελισσόφυλλον* or *μελισσαίνα* of Dioscorides;⁴ but Fraas⁵ is of opinion that the *Melissa altissima* is the species referred to by Dioscorides.

BOTANY. Gen. Char.—*Calyx* tubular-campanulate, 13-ribbed, 2-lipped, the upper lip nearly flat, 3-toothed, the inferior lip bifid, the throat naked within. Tube of the *corolla* recurved-ascending, enlarged from above, naked within, limb 2-lipped, upper lip emarginate erect, lower ones spreading, 3-cleft, the lobes flat, the middle one entire or emarginate. *Stamens* 4, arched-converging; cells of the anthers at length straggling. Lobes of the *style* nearly equal, subulate. *Nucules* dry, smooth (Benthams).

Sp. Char.—Erect, branching. *Leaves* broad-ovate, crenate, truncate or cordate at the base; the floral ones nearly similar to the cauline ones. *Whorls* axillary, loose, 1-sided. *Bracts* (floral leaves) few, ovate. *Corolla* longer by half than the calyx (Benthams).

Hab.—South of France.

PROPERTIES.—The fresh herb (*herba melissæ*) has a strong, peculiar odour, which is somewhat similar to that of lemons. By drying, this is, for the most part, lost. The taste is aromatic, bitter, and somewhat austere. Sesquichloride of iron gives a greenish colour (*tannate of iron*) to the cold infusion.

COMPOSITION.—The principal constituents of balm are *volatile oil*, *resin*, *bitter matter*, *gum*, *tannic acid*, and *woody fibre*.⁶

OIL OF BALM (*Oleum Melissa*) is pale yellow, and has the peculiar odour of balm. Its sp. gr. is 0.975. Oil of lemon is said to be frequently substituted for it.

PHYSIOLOGICAL EFFECTS.—The effects of balm are similar to, though milder than, those of the labiate plants already described. The mildness of its operation arises from the small quantity of volatile oil which the plant contains.

¹ The price at which the oil is sold by M. Sagnier, and other exporters at Nismes, is so low as to preclude its distillation in England.

² *Flora Græca Prodrromus*, vol. i. p. 423, 1806

³ *Lib. iii. cap. 118.*

⁴ *Pfaff, Mat. Med. Bd. iv. S. 270.*

⁵ *Hist. Rei Herb. t. i. p. 100.*

⁶ *Synopsis Plantarum Fl. Classicæ*, p. 152, 155.

USES.—*Balm tea* is sometimes employed as a diaphoretic in fevers, as an exhilarating drink in hypochondriasis, and as an emmenagogue in amenorrhœa and chlorosis.

TRIBE III. MONARDEÆ, Benth.

Stamens 2, straight or ascending; cells of the anthers oblong-linear, or solitary, or separated by the filiform connective (very rarely approximate in *Perowskia*).

165. ROSMARINUS OFFICINALIS, Linn.—COMMON ROSEMARY.

Sex. Syst. Diandria, Monogynia.

(*Oleum e cacumine florente destillatum, L.*—Tops, *E. D.*)

HISTORY.—The *Λιβανωτὶς στεφανωματικὴ*, or *Libanotis coronaria* of Dioscorides,¹ is supposed to be our officinal rosemary, which received its name, *Λιβανωτὶς* (from *Λιβανος, Thus*), on account of its odour, and *στεφανωματικὴ* (*στεφανωματικός, coronarius*), from its use in making garlands.² Pliny³ calls it *Rosmarinum*. The flowers are termed *anthos* (from *ἄθος, a flower*), signifying they are the *flowers* par excellence; just as we call *cinchona the bark*, and the inspissated juice of the poppy, *opium* (i. e. *the juice*).

BOTANY. *Gen. Char.*—*Calyx* ovate-campanulate, 2-lipped; the upper lip entire, the lower bifid, the throat naked within. *Corolla* with a protruding tube, smooth and not ringed in the inside, somewhat inflated in the throat; limb 2-lipped; lips nearly equal, the upper one erect and emarginate, the lower spreading, trifid, with the lateral lobes oblong, erect, somewhat twisted; the middle lobe very large, concave, and hanging down. No rudiments of the superior *stamina*; fertile (inferior) ones, 2, ascending, protruding; *filaments* inserted in the throat of the corolla, shortly-toothed near the base; *anthers* linear, subbilocular; the cells straggling, confluent, connate at the margin. Upper lobe of the *style* very short. *Nucules* dry, smooth (Bentham).

Sp. Char.—The only species.—*Leaves* sessile, linear, revolute at the edge, hoary beneath. *Calyx* purplish. *Corolla* white or pale purplish-blue.

Hab.—South of Europe; also Asia Minor.

PROPERTIES.—The flowering-tops (*cacumina rosmarini*) are the officinal parts. They have a strong and remarkable odour, and a warm bitter taste.

COMPOSITION.—The peculiar odour and flavour of this plant depend on *volatile oil*. Besides this, the tops contain *tannic acid*, a *bitter matter*, *resin*? and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Carminative and mildly stimulant, analogous to the other labiate plants.

USES.—Rarely employed medicinally. *Infusion of Rosemary* (*rosemary tea*) is sometimes used as a substitute for ordinary tea by hypochondriacal persons. The admired flavour of Narbonne honey depends on the bees collecting this substance from rosemary plants, which abound in the neighbourhood of Narbonne: hence sprigs of rosemary are sometimes added to the honey of other places, in order to imitate the flavour of Narbonne honey.

1. *OLEUM ROSMARINI, L. E. D. [U. S.]*; *Oleum Anthos*, offic.; *Oil of Rosemary*.—(Prepared by submitting the rosemary tops to distillation with water.)—This oil was first procured by Raymond Lully.⁴ It is transparent and colourless, with the odour of rosemary, and a hot, aromatic taste. Its sp. gr. is 0.897; and it boils at 365° F. It consists, according to Dr. Kane, of C⁴⁵H³⁸O³. One pound of the fresh herb yields about one drachm of the oil.⁵ It is rarely taken internally, but

¹ Lib. iii. cap. 89.

² Hist. Nat. lib. xix. cap. 62, ed. Vulp.

³ Brande, Dict. of Mat. Med. p. 466.

⁴ The Arabian name signifies "royal crown."

⁵ Thomson's Hist. of Chem. vol. i. p. 41.

is not unfrequently used externally, in conjunction with other substances, as a stimulating liniment; for example, in alopecia, or baldness, and also as a perfume. Dose, gtt. ij to gtt. v.

2. *SPIRITUS ROSMARINI*, L. E. D. [U. S.]; *Spirit of Rosemary*.—(Oil of Rosemary ʒij; Rectified Spirit Cong. j. Dissolve, *L.*—The *Edinburgh College* submits the tops, ʒiijss, to distillation with a gallon of Rectified Spirit, so as to obtain seven pints of the distilled spirit.)—It is usually prepared merely by dissolving the oil in spirit, distillation being superfluous. Seldom employed internally. Its principal use is as an odoriferous adjunct to lotions and liniments. It is a constituent of the *Linimentum Saponis* (see vol. i. p. 552), and *Tinctura Lavandulæ composita* (see ante, p. 442).

3. *ESSENTIA ROSMARINI*, D.; *Essence of Rosemary*.—(Oil of Rosemary fʒij; Rectified Spirit fʒix. Mix with agitation.)—Its uses are the same as those of the spirit just noticed.

4. *AQUA HUNGARICA*; *Aqua Rosmarini seu Anthos composita*; *Hungary Water*.—Various formulæ for the preparation of this perfume have been given. The following is from the *Pharm. Wurtem. and Bavar.*: Take of fresh Rosemary, in blossom, ʒiv; fresh Sage, in blossom, ʒvj; Zingiber ʒij. Cut into pieces, and add Rectified Spirit ʒxij; Common Water Oj. Let eleven pints distil by a gentle heat. A hermit is said to have given the formula for the preparation of this perfume to a queen of Hungary; whence this water has been called the *Queen of Hungary's Water* (*Aqua Reginae Hungariae*).¹ Hungary water is frequently imitated by mixing Spirit of Lavender fʒvij with Spirit of Rosemary fʒiv.—This liquid is employed principally as a perfume for the toilet; also as an excitant and restorative in fainting. Externally, it is used as a stimulating liniment.

TRIBE IV. STACHYDEÆ, *Benth.*

Stamens 4, ascending under the helmet (which is usually concave).

166. *MARRUBIUM VULGARE*, Linn.—WHITE HOREHOUND.

Sex. Syst. Didynamia, Gymnospermia.
(Herba.)

HISTORY.—This is the plant which is called *Ἠράσιον* by Hippocrates, Theophrastus, and Dioscorides;² and *Marrubium* by Pliny.³

BOTANY. *Gen. Char.*—*Calyx* tubular, 5—10-nerved, equal; teeth 5—10, acute, somewhat spinous, nearly equal, erect, or often spreading at maturity. *Corolla* with an inclosed tube, which is naked inside, or somewhat annulated, and a 2-lipped limb; the upper lip erect, flattish or concave, entire or shortly bifid; the lower lip trifid, spreading, the middle lobe the broadest, often emarginate. *Stamens* inclosed within the tube of the corolla; anthers with 2 straggling, somewhat confluent cells, all nearly alike. *Style* bifid at the apex, with short obtuse lobes. *Nucules* obtuse, not truncate at the apex (*Bentham*).

Sp. Char.—*Branches* white-woolly. *Leaves* ovate or rounded, softly villous, greenish or white-woolly beneath, crenate. *Whorls* many-flowered. *Calyx* villose, woolly, with 10 subulate, recurved-spreading or woolly teeth. *Corolla* with an oblong helmet, bifid at the point (*Bentham*). *Flowers* white.

Hab.—Dry waste grounds. Indigenous. Grows in most parts of Europe; also in Asia and America. Flowers in July.

PROPERTIES.—The whole herb (*herba marrubii*) is used in medicine. It has an aromatic odour, and a bitter taste. Sesquichloride of iron communicates an olive-green tint (*tannate of iron*) to the cold watery infusion.

¹ For the history of Hungary water, see Beckmann's *History of Inventions*, translated by Wm. Johnston, vol. ii. p. 107, 1791.

² Lib. iii. cap. 119.

³ *Hist. Nat. lib. xx. cap. 89, ed. Valp.*

COMPOSITION.—Its bitterness depends on *extractive*; its aromatic properties on *volatile oil*. Besides these principles it contains *resin*, *tannic acid*, *bitter matter*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Horehound is tonic, mildly stimulant, and, in large doses, laxative. Taken in the form of infusion, it promotes the secretions of the skin and kidneys. It was formerly supposed to possess emmenagogue properties.

USES.—It is rarely employed by medical practitioners. As a domestic remedy it is used in chronic pulmonary complaints, especially catarrh. It was formerly given in uterine and hepatic affections.

ADMINISTRATION.—*Horehound tea* (prepared by infusing an ounce of the herb in a pint of boiling water) is taken in the dose of a wineglassful. *Syrup of horehound* (prepared with the infusion and sugar) is a popular remedy, and is kept in the shops. *Candied horehound* ought to be made of the same ingredients.

BALLOTA NIGRA, Linn., or *Stinking Black Horehound*, possesses similar properties to the *Marrubium vulgare*.

ORDER XLI. SCROPHULARIACEÆ, Lindley.—FIGWORTS.

PEDICULARES ET SCROPHULARIÆ, Juss.—SCROPHULARINÆ, R. Brown.

CHARACTERS—*Flowers* hermaphrodite, usually irregular. *Calyx* free, persistent, 5—4-merous. *Corolla* gamopetalous (monopetalous), hypogynous, pentamerous or (the upper petals being united) tetramerous, very rarely 6—7-merous, or 2-lobed, the lobes being united; bilabiatedly or irregularly imbricated, very rarely (in a few didynamous or diandrous genera) plaited in æstivation. *Stamens* inserted on the corolla, alternate with its lobes; the upper stamen usually, and the 2 anterior or posterior ones sometimes, sterile or deficient; *anthers* 2 celled, or by growing together or by half disappearing, 1-celled; the cells dehiscing by a longitudinal slit. *Ovary* free, 2-celled; ovules in each cell many (very rarely 2 together), inserted on the dissepiment near the axis, anatropal or amphitropal. *Style* simple, or very shortly bifid, at the apex; the stigmatic part either very thin, or incrassate, entire, or 2-lobed. *Fruit* capsular, dehiscing, variously or rarely baccate. *Placentæ* 4, separate by dehiscence, or united variously with each other, with the edges of the valves, or with the central column. *Seeds* albuminous, indefinite with the radicle towards the basilar hilum, or few and definite with a more or less lateral hilum, and the radicle towards the apex of the fruit; embryo straight, or rarely curved.—*Herbs, undershrubs, or rarely shrubs*. *Leaves* opposite, whorled, or alternate. *Stipules* commonly absent. *Inflorescence* centrifugal or centripetal. *Bracts* 2, opposite, or solitary; *bractlets* none, or 1 or 2, alternate, or nearly opposite (Bentham).

PROPERTIES.—Juice watery, frequently bitter, astringent or narcotic.

167. VERBASCUM THAPSUS, Linn.—GREAT MULLEIN OR HIGH TAPER.

Sex. Syst. Pentandria, Monogynia.
(Folia.)

HISTORY.—This plant is, according to both Smith¹ and Fraas,² the φλίμας λευκή ἢ ἄγρην of Dioscorides.³

BOTANY. Gen. Char.—*Calyx* deeply 5-cleft or 5-partite, rarely 5-toothed. *Corolla* flat, expanded, or rotate, rarely concave; the segments scarcely unequal. *Stamens* 5; the filaments either the 3 posterior ones, or all woolly or bearded, rarely (abnormally?) naked. *Style* compressed dilated at the apex, rather thick. *Capsule* globose, ovoid or oblong, dehiscing (Bentham).

Sp. Char.—Nearly simple, densely yellowish or whitish, tomentose. Radical leaves oblong, crenulate; those of the stem decurrent, winged, acuminate. *Raceme* dense, or interrupted at the base. Throat of the *corolla* concave. *Anthers* inferior, shortly decurrent (Bentham).—*Corolla* golden yellow; *stamens* red; *stigma* green.

Hab.—Indigenous; on banks and waste ground. Biennial. Flowers in July and August.

DESCRIPTION.—The leaves (*folia verbasci*) have a mucilaginous, bitterish taste, and a very slight odour. They communicate their virtues to water.

COMPOSITION.—Morin⁴ analyzed the flowers of *Verbascum Thapsus*, and obtained a yellow

¹ Fl. Græca Prodr. vol. i. p. 149.

² Lab. iv. cap. 104.

³ Synopsis Plant. Fl. Class. p. 191, 1845.

⁴ Journ. de Chim. Méd. t. ii. p. 223.

volatile oil, a fatty acid, free malic and phosphoric acids, malate and phosphate of lime, acetate of potash, uncrystallizable sugar, gum, chlorophyll, and yellow resinous colouring matter.

PHYSIOLOGICAL EFFECTS.—Emollient, demulcent, and supposed to be feebly narcotic. Fishes are stupefied by the seeds of *Verbascum*.¹

USES.—In the form of decoction (prepared of $\frac{3}{4}$ of the leaves and Oij of water) mullein has been used in catarrhs and diarrhæas; the dose is $\frac{f\text{3}}{iv}$. Dr. Home² found it serviceable in the later complaint only. Fomentations and cataplasms made of great mullein have been used as applications to hemorrhoidal tumours and indurated glands.

168. SCROPHULARIA NODOSA, Linn.—KNOTTY-ROOTED FIGWORT.

Sex. Syst. Didynamia, Angiospermia.
(Folia.)

HISTORY.—The earliest notice of this plant occurs in the work of Brunfels.³

BOTANY. Gen. Char.—*Calyx* deeply 5-cleft or 5-partite. Tube of the *corolla* ventricose, globular, or oblong; segments of the limb short, the 4 upper ones erect, the lower one spreading, 2 upper ones usually longest. *Stamens* didynamous, declinate, cells of the anthers united transversely into one; the rudiment of a fifth sterile stamen at the apex of the squamiform tube often present. *Capsule* usually acute, the valves entire or bifid at the apex. *Seeds* ovoid, rugose (Bentham).

Sp. Char.—Smooth. *Stem* angular. *Leaves* ovate, ovate oblong, or the upper ones lanceolate, acute, serrate or somewhat incised, broadly cordate or rounded at the base. *Thyrus* oblong, beardless, or scarcely clothed with leaves at the base. *Cymes* pedunculate, loosely many-flowered. Segments of the *calyx* broadly ovate, obtuse, with the margin very narrow. The sterile *anther* broadly orbiculate (Bentham).—*Corolla* dull green, with a livid purple lip.

Hab.—Indigenous; hedges, woods, and thickets. Perennial. Flowers in July.

DESCRIPTION.—The fresh leaves (*folia scrophulariæ nodosæ*) have, when bruised, a fetid odour; their taste is bitter, and somewhat acrid. Water extracts the virtues of the plant; the infusion is darkened by the sesquichloride of iron, but is unchanged by tincture of nutgalls.

COMPOSITION.—The whole plant (root and herb) was analyzed in 1830 by Grandon.⁴ He obtained brown bitter resin 0.31, extractive with gum 4.84, extractive having the odour of benzoic acid 0.88, chlorophyll 1.58, starch 0.23, greenish fecula 0.18, mucilage 0.27, inulin 0.16, malic acid 0.15, peptic acid 0.15, acetic acid 0.13, woody fibre 19.80, water 70.31, sulphate and carbonate of potash 0.59, alumina 0.20, oxalate and carbonate of lime 0.46, magnesia, 0.26, silica 0.07, odorous matter and loss 0.31.

PHYSIOLOGICAL EFFECTS.—But little known. Judging from their taste, the leaves possess acrid properties. When swallowed, they occasion vomiting and purging. They are said to be diuretic and narcotic.

USES.—Rarely employed. In the form of a fomentation, the leaves are sometimes applied to piles and other painful tumours. The ointment is used in skin diseases. The tuberous root was formerly esteemed in scrofula.⁵

UNGUENTUM SCROPHULARIÆ; Ointment of Scrophularia.—(Fresh leaves of *Scrophularia nodosa*, Prepared Hog's Lard, of each ℥ij ; Prepared Mutton Suet ℥ij . Boil the leaves in the fat until they become crisp, then strain by expression.)—Recommended by Dr. W. Stokes⁶ for the cure of a disease of children, commonly termed *burnt-holes*, and which he calls *Pemphigus gangrenosus* [*Rupia escharotica*?]. It has also been used in tinea capitis, impetigo, and other cutaneous affections.⁷

169. Gratiola Officinalis, Linn.—Officinal Hedge Hyssop.

Sex. Syst. Diandria, Monogynia.
(Herba.)

A perennial plant, native of the South of Europe. Cultivated in England, and formerly contained in the British Pharmacopœias. The herb (*herba gratiolæ*) is cathartic, diuretic, and emetic, acting in large doses as an acrid poison. It has been used in visceral obstructions, liver affections, dropsies, scrofula, and venereal diseases. Dose of the powder gr. xv to ʒss ; of the infusion (prepared with ʒij of the dried herb and Oss of boiling water), ʒss to ʒj , three times a day.⁸

¹ Bergius, *Mat. Med.*

² Sprengel, *Hist. Rei Herb. Præf. xi.*

³ Murray, *App. Med.* vol. ii. p. 224.

⁴ Dr. Montgomery, *Observ. on the Dubl. Pharm.*

⁵ *Clin. Exp. and Hist.*

⁶ *Pharm. Central-Blatt für 1831*, S. 446.

⁷ *Dubl. Med. Essays*, p. 146.

⁸ *Thomson, Lond. Dispensat.*

170. DIGITALIS PURPUREA, Linn.—PURPLE FOXGLOVE.

Ses. Syst. Didynamia, Angiospermia.

(Herbæ agrestis Folium caulinum recens et exsiccatum, L.—Leaves, E. D.)

HISTORY.—It appears very improbable that the ancients should have overlooked so common and elegant a plant as foxglove; yet in none of their writings can we find any plant whose description precisely answers to the one now under examination. Fabricius Columna¹ thought that it was the *Ἐφῆμερον* of Dioscorides,² but the description of the latter does not at all agree with foxglove. The *Βάκχαρις*³ of the same writer has also been referred to, but with little more probability of correctness. The term *Foxer glove*, occurs in a MS., *Glossarium Ælfrici*, probably written before the Norman Conquest (A. D. 1066), and in a MS. Saxon translation of L. Apulius; both of which are among the Cottonian manuscripts in the British Museum.⁴ Fuchsius⁵ is usually regarded as the earliest botanist who mentions this plant, which he named *Digitalis* (from *Fingerhut*, a finger-stall, on account of the blossoms resembling the finger of a glove). Fuchsius states that, until he gave it this appellation, the plant had no Greek or Latin name.

BOTANY. *Gen. Char.*—*Calyx* 5-partite, imbricate. *Corolla* declinate; tube ventricose or campanulate, frequently constricted above the base; upper segment of the limb short, broad, emarginate or bifid, spreading, the external lateral ones narrower, the lowermost one longer than the others, extended. *Stamens* 4, didynamous, ascending, shorter than the corolla, and frequently inclosed within the tube; *anthers* approximated in pairs, their cells diverging and confluent. *Style* briefly bilobed at the apex; the lobes stigmatic within. *Capsule* ovate, 2-valved, with septicidal dehiscence; the valves entire, curved inwards at the margins, half exposing the placentiferous column. *Seeds* numerous, minute, oblong, somewhat angular (Bentham).

Sp. Char.—*Leaves* ovate-lanceolate or oblong, crenate, rugose; the under surface or both surfaces, as well as the stem, tomentose or woolly. *Raceme* long, lax. Segments of the *calyx* ovate or oblong. *Corolla* enlarged above, campanulate; its segments obtuse, shorter than broad, the lower one longer than the lateral ones.

Herbaceous. *Root* of numerous long and slender fibres; biennial. *Stem* erect, 3 or 4 feet high, commonly simple, roundish, with several slight angles, downy. *Leaves* alternate, downy, veiny, of a dull green; tapering at the base into winged foot-stalks; lower ones largest. *Raceme* terminal, erect, one-sided, simple, of numerous, large, pendulous, odourless flowers. *Corolla* crimson, elegantly marked with eye-like spots, as well as hairy, within.

Var. albiflora.—A variety with white flowers, spotted with shades of cream-colour or pearl, is met with in gardens; it remains tolerably constant from seed.

Hab.—Indigenous; in pastures and about hedges or banks, on a gravelly or sandy soil.

DESCRIPTION.—The officinal parts of the leaves and seeds; the latter, however, are rarely employed. As some doubts have been expressed as to the equal activity of cultivated specimens, wild or native plants are to be preferred.

1. *Foxglove leaves (folia digitalis).*—The leaves should be gathered when the plant is in the greatest perfection—that is, just before or during the period of inflorescence; and those are to be preferred which are full-grown and fresh. As the petioles possess less activity than the laminae or expanded portions of the leaves, they ought to be rejected. Dr. Withering⁶ directs the leaves to be dried either in the sunshine, or in a tin pan or pewter dish before the fire; but the more

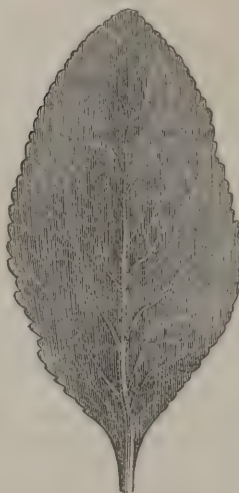
¹ Quoted by Mentzelius, *Index Nom. Plant.* p. 104.² Lib. iii. cap. 51.³ *Hist. Strep.* 1542.⁴ Lib. iv. cap. 85.⁵ *Lyc. Dict. Saxon.*⁶ *Account of the Foxglove*, p. 181, 1785.

Fig. 306.



First year's leaf.

Fig. 307.



Second year's leaf.

Foxglove Leaves.

usual, and, I believe, better mode of proceeding, is to dry them in baskets in a dark place, in a drying-stove. Both dried leaves and powder should be preserved in well-stoppered bottles, covered externally by dark-coloured paper, and kept in a dark cupboard. As both undergo changes by keeping, whereby their medicinal activity is considerably diminished, they ought to be renewed annually. Dried foxglove leaves have a dull green colour, a faint odour, and a bitter, nauseous taste.

Although the leaves should be collected just before or at the period of inflorescence; that is, in the second year of the plant's growth, yet not infrequently the first year's leaves, which are considered to be of inferior activity, are sometimes substituted for them.

The first year's leaves are frequently more tapering than those of the second year's growth; but this character is not much to be relied on; and, therefore, to avoid the substitution, the best and safest plan is to purchase the fresh leaves at the proper season—namely, just before or at the period of inflorescence (which is from the middle of June to the end of July).

The leaves of *Inula Conyza*, De Cand., or *Ploughman's Spikenard*, closely resemble those of Foxglove; but, when rubbed, are readily distinguished by their odour, which, by some, is called aromatic, by others fetid. Moreover, they are rougher to the touch, and are less divided on the edge.

Subsessile or shortly petiolate, ovate-lanceolate or oblong, narrow at the base, crenate, rugous and veined, tomentose beneath or on both sides.

It is to be gathered before the terminal flowers have unfolded. The petiole and midrib being removed, dry the lamina. (*Pharm. Lond.*)

2. *Foxglove seeds (semina digitalis)*.—The seeds of the foxglove are small, roundish, and of a grayish-brown colour.

COMPOSITION.—Purple foxglove has been the subject of repeated chemical examination, but, until very recently, with no satisfactory results. Memoirs on its composition, or on its active principle, have been published by Destouches,¹ Bidault de Villiers,² Rein and Haase,³ Le Royer,⁴ Dulong d'Astafort,⁵ Meylink,⁶ Welding,⁷ Radig,⁸ Brault and Poggiale,⁹ Lancelot,¹⁰ Trommsdorff,¹¹ Homolle,¹² Nativelle,¹³ and by Morin.¹⁴ Homolle's memoir gained the prize offered by the Société de Pharmacie of Paris for the isolation of the active principle.

¹ *Bull. de Pharm.* t. i. p. 123.

² *Essai sur les Propr. méd. de la Digit. pourp.* 3e édit. 1812.

³ *Diss. de Digit. purp.* 1812, quoted in Schwartze's *Pharm. Tabell.*

⁴ *Bibl. Univers. des Sciences*, t. xxvii. p. 102, 1821, Genève.

⁵ *Journ. de Pharm.* t. xiii. p. 379, 1827.

⁶ *Burhuers's R.-port. für d. Pharm.* Bd. xxviii. p. 237, 1829.

⁷ *Journ. of the Philadelphia Coll. of Pharm.* July, 1833.

⁸ *Pharm. Central-Blatt.* für 1835, S. 209.

⁹ *Pharm. Central-Blatt* für 1833, p. 620.

¹⁰ *Journ. de Pharm. et de Chim.* 3e sér. t. vii. p. 57.

¹¹ *Journ. de Chim. Méd.* 2e sér. t. xi. p. 62, 1845.

¹² *Journ. de Pharm. et de Chim.* 3e sér. t. vii. p. 295, 1845.

¹³ *Journ. de Pharm.* t. xxi. p. 130, 1835.

¹⁴ *Ibid.* 1837, p. 663.

Radig's Analysis.	Brault and Poggiale's Analysis.	Nativelle's Analysis.
Picrin (Digitaline of Le Royer) 0.4	Resin.	Digitaline combined with tannic acid.
Digitaline (of Lancelot) . . . 8.2	Fatty matter.	Crystallizable substance.
Scaptin (acid extractive) . . . 14.7	Chlorophylle.	Aromatic principle.
Chlorophylle 6.0	Starch.	Crystallizable resinous matter.
Oxide of iron 3.7	Gum.	Fixed oil.
Potash 3.2	Lignin.	Sugar.
Acetic acid 11.0	Tannin.	Red colouring matter soluble in water.
Vegetable albumen 9.3	Salts of lime and potash.	Chlorophylle. •
Woody fibre 43.6	Volatile oil.	Extractive.
	Fixed oil.	Albumen.
	Oxalate of potash.	Salts containing vegetable acids.
		Salts containing inorganic acids.
Foxglove leaves . . . 100.1	Foxglove leaves.	Foxglove leaves.

Morin found a peculiar volatile acid (*antirrhinic acid*), and a peculiar non-volatile acid (*digitalic acid*).

1. DIGITALINE; *Bitter Principle of Foxglove; Picrin*.—Homolle's process for obtaining digitaline, as simplified by M. Ossian Henry,¹ is as follows: Digest 2½ lbs. of carefully dried and powdered foxglove leaves with rectified spirit; and express the tincture strongly in a press. Draw off the spirit in a still, and treat the residual extract with half a pint of water acidulated with about two drachms of acetic acid. Digest with a gentle heat, add some animal charcoal, and filter. Dilute the filtered liquor with water, partly neutralize with ammonia, and add a fresh-made strong infusion of nutgalls; by this means tannate of digitaline is precipitated. Wash the precipitate with water, mix it with a little alcohol, and carefully rub it with finely powdered litharge. Expose the mixture to a gentle heat, digest with alcohol, decolorize the tincture by animal charcoal, and draw off the alcohol by a gentle heat. The residual extract is then to be treated with sulphuric ether, which takes up some foreign matters and leaves the digitaline. From 1 kilogramme (about 2½ lbs. 8 oz. troy) of the leaves, O. Henry obtained from 140 to 150 grs. of digitaline.

Digitaline is white, inodorous, difficultly crystallizable, and usually occurs in porous mammillated masses, or in small scales. It is intensely bitter when in solution, and excites violent sneezing when it is pulverized. It is soluble in about 2000 parts of water, is very soluble in alcohol, but almost insoluble in ether. It does not contain nitrogen; nor does it neutralize acids. Concentrated sulphuric acid blackens it, and then dissolves it, forming a blackish-brown solution, which, in a few days, becomes successively reddish-brown, smoky amethyst, pure amethyst, and ultimately a beautiful crimson. If during this time a small quantity of water be added, a limpid, beautiful green solution is obtained. In concentrated and colourless hydrochloric acid digitaline dissolves, forming a solution, which passes from yellow to a fine green. This reaction Homolle considers to be sufficiently delicate for medico-legal researches.

The effects of digitaline on both animals and the human subject have been examined by Homolle, and by Bouchardat and Sandras.² From their experiments, it appears that its effects are similar to those of the plant; but that it is at least 100 times as powerful as the powder of the dried plant. In the human subject, doses of from 2 to 6 milligrammes (from about 1-32d to 1-11th of an English grain) diminished the frequency of the pulse, and caused nausea, vomiting, griping, purging, and increased secretion of urine.

Digitaline has been employed in medicine, as a substitute for the plant, in doses of from 1-60th to 1-30th of a grain. It may be administered in substance in the form of pills, or dissolved in alcohol and given in the form of mixture or syrup. But the difficulty of adjusting these small doses, as well as the uncertainty of the purity and activity of the remedy, are great drawbacks to its use.

2. SCAPTIN.—Radig has applied the term scaptin to a brown, almost tasteless extractive, which leaves an acid sensation in the throat.

3. EMPYREUMATIC OIL OF FOXGLOVE (*Pyrodigitaline*).—By the destructive distillation of the dried leaves of foxglove, Dr. Morris³ obtained a coloured, disagreeable, empyreumatic oil, which was semi-solid at 60° F., and soluble in boiling alcohol and ether; the solution, on cooling, let fall a flocculent precipitate composed of two substances; one crystalline, the other globular. Given to a rabbit, it caused paralysis of the hind legs, convulsions, laborious and rapid breathing, and accelerated action of the heart. It does not contain the sedative principle of foxglove.

CHEMICAL CHARACTERISTICS.—Sesquichloride of iron causes a dark precipitate (*tanno-gallate of iron*) with decoction of foxglove leaves, as well as with the tincture diluted with water. A solution of gelatine, added to the decoction, causes, after some time, a scanty precipitate (*tannate of gelatine*). Tincture of nutgalls

¹ *Ibid.* 3e sér. t. vii. p. 460, 1845.

² *Ed. Med. and Surg. Journ.* vol. xxxix. p. 377.

³ *Annuaire de Thérapeutique pour 1845*, p. 60.

has scarcely any effect (perhaps a slight turbidness) when added to the decoction or to the tincture diluted with water.

(By the action of sulphuric or hydrochloric acid on the tincture or decoction of foxglove, I have not been able to detect the presence of digitaline.)

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Marcet¹ found that a solution of the watery extract of foxglove killed a haricot plant (*Phaseolus vulgaris*) in twenty-four hours.

β. On Animals generally.—The effects of foxglove have been tried on dogs,² horses, rabbits,³ turkeys,⁴ the domestic fowl, and frogs; and on all it has been found to act as a poison. One drachm of the powder may be given to horses as a sedative in inflammation.⁵ Two ounces have produced death in twelve hours.⁶ According to the experience of Orfila, the first symptoms of poisoning observed in [carnivorous] animals is vomiting. The influence of the poison over the heart does not appear to be uniform; for in some cases he found the pulsations of this viscous unaltered, in others accelerated, while occasionally they were retarded. In the horse killed by two ounces of foxglove, the pulse was 130 per minute, a short time before death (Moiroud)—the standard pulse of the horse being 40 or 42 per minute. The cerebro-spinal symptoms observed in animals, are diminished muscular power, convulsive movements, tremors, and insensibility. The powder acts as a local irritant, giving rise to inflammation of parts to which it is applied (Orfila).

γ. On Man.—We may, for convenience, establish three degrees of the operation of foxglove.

In the first degree, or that produced by *small and repeated doses*, foxglove sometimes affects what are termed the organic functions, without disordering the animal or cerebro-spinal functions. Thus we sometimes have the stomach disordered, the pulse altered in frequency, and sometimes also in fulness and regularity, and the secretion of urine increased, without any other marked symptoms. The order in which the symptoms just mentioned occur is not uniform; sometimes the diuresis, at others nausea, and occasionally the affection of the circulation, being the first obvious effect.

The influence of foxglove over the circulation is not at all constant. In some cases the frequency of the pulse is augmented, in others decreased, while in some it is unaffected. Lastly, in a considerable number of instances, the pulse becomes irregular or intermittent under the use of foxglove.⁷ A few drops of the tincture will, in some cases, reduce the frequency of the pulse, and render it irregular and intermittent, while in other instances much larger doses may be taken without any obvious effect on it. Dr. Withering⁸ mentions one case in which the pulse fell to 40; and I have several times seen it reduced to 50. In some cases the slowness of the pulse is preceded by an increased activity of the vascular system. From Sandras's reports⁹ this would appear to occur more frequently after small than large doses of foxglove. Dr. Sanders,¹⁰ indeed, asserts that foxglove invariably excites the pulse, and refers to an experience of 2000 cases in proof. He says, that he has seen the pulse rise from 70 to 120 under the use of foxglove, and at the end of twenty-four hours, or sooner, fall with greater or less rapidity to forty, or even below this. But an experience of the use of foxglove, in only twenty cases, will, I believe, convince most persons that Dr. Sanders has fallen into an error in the sweeping assertion which he has made. A great deal, however, depends on the position of the patient. If it be desired to reduce the frequency of the pulse, the patient should be kept in a recumbent posture. The important influence of posture was first pointed out, I believe, by Dr. Baildon.¹¹ His own pulse, which had been reduced by this plant from 110 to 40 beats per minute while he was in the recum-

¹ *Ann. de Chim. et de Phys.* vol. xxix. p. 200.

² Le Roger, *Bibl. Univ.* June, 1824.

³ Youatt, *The Horse, in Libr. of Usef. Knowledge.*

⁴ See the statistical resumé of Sandras, *Bull. de Thérap.* t. vi.

⁵ *Account of the Foxglove*, p. 73, 1785.

⁶ *Treat. on Pulm. Consumption*, ed. 1808.

⁷ Orfila, *Toxicol. Gén.*

⁸ Salerne, *Hist. de l'Acad. des Scienc.* p. 84, 1749.

⁹ Moiroud, *Pharm. Véter.* p. 354.

¹⁰ *Op. cit.*

¹¹ *Ed. Med. and Surg. Journ.* vol. iii. p. 270.

bent position, rose to 70 when he sat up, and to 100 when he stood. We have a ready explanation of this fact. In a state of health, the pulsations of the heart are more frequent (usually to the extent of five or six in the minute) in the erect than in the horizontal position; and it is very obvious that greater force is required to carry on the circulation in the former than in the latter, since, in the erect position, the heart and arteries have to send blood to the head against gravity. Now, the power of the heart being enfeebled by foxglove, when a demand is made on this viscus for an increase in the force of contractions by the change from the recumbent to the standing attitude, it endeavours to make up for its diminished force by an increase in the frequency of its contractions. I need scarcely add, that the sudden change of position in those who are much under the influence of this medicine, is attended with great danger, and in several instances has proved fatal; for, in consequence of the heart not having sufficient power to propel the blood to the head against gravity, fatal syncope has been the result.¹ The influence of digitalis over the pulse is more marked in some individuals or cases than in others; thus the reduction of the frequency of the pulse is in general more readily induced in weak and debilitated constitutions, than in robust and plethoric ones. Occasionally, no obvious effect on the number, force, or regularity of the pulse is produced, though the foxglove may be given to an extent sufficient to excite vomiting and cerebral disorder. Shroek² experienced, from two grains of foxglove, nausea, headache, small, soft, and quick pulse, dryness of the gums and throat, giddiness, weakness of limbs, and increased secretion of saliva. Some hours after, he observed sparks before the eyes, his vision became dim, and he experienced a sensation of pressure on the eyeballs.

A most important fact connected with the repeated uses of small doses of it, is the *cumulative effect* sometimes observed. It has not unfrequently happened that, in consequence of the continued use of small doses of this medicine, very dangerous symptoms, in some cases terminating in death, have occurred. The most prominent of these were great depression of the vascular system, giddiness, want of sleep, convulsions, and sometimes nausea and vomiting.³ A knowledge of its occasional occurrence impresses us with the necessity of exercising great caution in the use of this remedy, particularly with respect to the continuance of its administration and increase of dose; and it shows that, after the constitutional effect has become obvious, it is prudent to suspend from time to time the exhibition of the remedy, in order to guard against the effects of this alarming accumulation. I may add, however, that I have used it, and seen others employ it, most extensively, and in full doses, and have rarely seen any dangerous consequences; and I believe, therefore, the effects of accumulation to be much less frequent than the statements of authors of repute would lead us to expect. The experience of Dr. Holland⁴ is to the same effect. "Though employing the medicine somewhat largely in practice," he observes, "I do not recollect a case in which I have seen any injurious consequences from this cause."

The diuretic operation for which we employ foxglove is very inconstant. Dr. Withering stated that this medicine more frequently succeeds as a diuretic than any other, and that if it fail, there is but little chance of any other remedy succeeding. My experience, however, is not in accordance with Dr. Withering's. I have frequently seen foxglove fail in exciting diuresis, and have often found the infusion of common broom (*Cytisus scoparius*) subsequently succeed. It has been asserted by some, that the diuretic effect of foxglove was only observed in dropsical cases, and that it, therefore, depended on the stimulus given to the absorbent vessels, and not to any direct influence exerted over the kidneys; but the statement is not true,

¹ For some interesting remarks on the *Effects produced by Posture on the Pulse*, by Dr. Graves, consult *Dubl. Hosp. Rep.* vol. x. p. 561.

² Quoted by Withering, *Wirk. d. Arzneim u. Gifte*, Bd. ii. S. 311.

³ See the cases published by Dr. Withering, *op. cit.*; also a fatal case recorded by Dr. Blackall, *On Dropsy*, p. 176, 4th ed.

⁴ *Med. Notes and Reflections*, p. 514.

since foxglove is sometimes found acting as a diuretic even in health. In some cases the bladder has appeared more irritable than usual, the patient having a frequent desire to pass his urine.

An increased flow of saliva is an occasional consequence of the continued use of moderate doses of foxglove. Dr. Withering¹ first noticed this effect. Dr. Barton² has also seen it produced from ordinary doses.

2. The *second degree of operation of digitalis*, or that ordinarily resulting from the use of too large or too long-continued doses, is manifested by the disordered condition of the alimentary canal, of the circulating organs, and of the cerebro-spinal system. The more ordinary symptoms are nausea or actual vomiting, slow and often irregular pulse, coldness of the extremities, syncope, or tendency to it, giddiness, and confusion of vision. Sometimes the sickness is attended with purging, or even with diuresis; at other times the patient is neither vomited nor purged; and the principal disorder of system is observed in the altered condition of the nervous and vascular organs. External objects appear of a green or yellow colour; the patient fancies there is a mist, or sparks, before his eyes; a sensation of weight, pain, or throbbing of the head, especially in the frontal region, is experienced; giddiness, weakness of the limbs, loss of sleep, occasionally stupor or delirium, and even convulsions, may also be present. The pulse becomes feeble, sometimes frequent, sometimes slow; there may be actual syncope, or only a tendency to it, and profuse cold sweats. Salivation is sometimes produced by poisonous doses of foxglove. It was observed in a case narrated by Dr. Henry,³ and has been known to last three weeks.⁴

The quantity of digitalis that may be given to a patient without destroying life, is much greater than is ordinarily imagined. In one instance I saw twenty drops of the tincture given to an infant labouring under hydrocephalus, three times daily for a fortnight, at the end of which time the little patient was completely recovered, without one untoward symptom. I have frequently given a drachm of the tincture (of the best quality) three times daily to an adult, for a fortnight, without observing any marked effect. I know that some practitioners employ it in much larger doses (as an ounce or half an ounce of the tincture), with much less effect than might be imagined. The following communication on this subject, from my friend Dr. Clutterbuck, illustrates this point: "My first information on this subject was derived from an intelligent pupil, who had been an assistant to Mr. King, a highly respectable practitioner at Saxmundham, in Suffolk, who on a subsequent occasion, personally confirmed the statement. This gentleman assured me, that he had been for many years in the habit of administering the tincture of digitalis, to the extent of from half an ounce to an ounce at the time, not only with safety, but with the most decided advantage, as a remedy for acute inflammation—not, however, to the exclusion of bloodletting, which, on the contrary, he previously uses with considerable freedom. To adults he often gives an ounce of the tincture (seldom less than half an ounce), and awaits the result of twenty-four hours, when, if he does not find the pulse subdued, or rendered irregular by it, he repeats the dose; and this, he says, seldom fails to lower the pulse in the degree wished for; and when this is the case, the disease rarely fails to give way, provided it has not gone the length of producing disorganization of the part. He has given as much as two drachms to a child of nine months. Sometimes vomiting quickly follows these large doses of the digitalis, but never any dangerous symptom, as far as his observation has gone, which has been very extensive. In less acute cases he sometimes gives smaller doses, as thirty drops, several times in a day.

"Such is the account I received from Mr. King himself, and which was confirmed by his assistant, who prepared his medicines. I do not see any ground for questioning the faithfulness of the report. I have myself exhibited the tincture to the

¹ *Op. cit.* p. 184.

² *Ed. Med. and Surg. Journ.* vol. vii. p. 148.

³ *Beck's Med. Jurisprudence.*

⁴ *Rust's Magazin.* xxv. p. 578.

extent of half an ounce (never more), in not more than two or three instances (cases of fever and pneumonia). To my surprise, there was no striking effect produced by it; but I did not venture to repeat the dose. In numerous instances I have given two drachms; still more frequently one drachm; but not oftener than once in twenty-four hours, and not beyond a second or third time. Two or three exhibitions of this kind I have generally observed to be followed by slowness and irregularity of pulse, when I have immediately desisted." Dr. T. Williams¹ states, that a man, in a state of intoxication, took two ounces of tincture of foxglove, in two doses, in quick succession, without the slightest inconvenience.

3. The *third degree* of the operation of foxglove, or that resulting from the use of *fatal doses*, is characterized usually by vomiting, purging, and griping pain in the bowels; slow, feeble, and irregular pulse, great faintness, and cold sweats; disordered vision; at first giddiness, extreme debility; afterwards insensibility and convulsions, with dilated insensible pupils.

If we compare the effects of foxglove with those of other medicinal agents, we find they approximate more closely to those of tobacco than of any other cerebro-spinant. These two agents especially agree in their power of enfeebling the action of the heart and arteries (see vol. i. p. 258). Green tea agrees with foxglove in its property of preventing sleep (see vol. i. p. 247). Considered as a diuretic, foxglove is, in some respects, comparable with squills. I have already pointed out the peculiarities attending the operation of each of these.

USES.—We employ foxglove for various purposes, as—1stly, to reduce the frequency and force of the heart's action; 2dly, to promote the action of the absorbents; 3dly, as a diuretic; and 4thly, sometimes on account of its specific influence over the cerebro-spinal system.

In the following remarks on the uses of foxglove in particular diseases, I refer to the administration of this remedy in the doses in which it is ordinarily employed. I have no experience of its therapeutical effects, when given in the enormous quantities mentioned by Dr. Clutterbuck.

1. *In fever*.—Digitalis is occasionally useful in fever to reduce the frequency of the pulse, when the excitement of the vascular system is out of proportion to the other symptoms of fever, such as the increased temperature, and the cerebral or gastric disorder. It cannot, however, be regarded, in the most remote way, as a curative means; on the other hand, it is sometimes hurtful. Thus, not unfrequently it fails to reduce the circulation; nay, occasionally, it has the reverse effect, accelerates the pulse, while it increases the cerebral disorder, and perhaps irritates the stomach. In estimating its value as a remedial agent for fever, we must not regard it as a sedative means (I refer now to the vascular system) merely; it is an agent which exercises a specific influence over the brain; and, therefore, to be able to lay down correct indications or contraindications for its use in disordered conditions of this viscus, we ought to be acquainted, on the one hand, with the precise nature of the influence of the remedy, and, on the other, with the actual condition of the brain in the disease which we wish to relieve. Now, as we possess neither of these data in reference to fever, our use of foxglove is, with the exception of the sedative influence over the circulation, empirical; and experience has fully shown us it is not generally beneficial. But, I repeat, where the frequency of pulse bears no relation to the local or constitutional symptoms of fever, foxglove may be serviceable.

2. *Inflammation*.—Foxglove has been employed in inflammatory diseases, principally on account of its power of reducing the frequency of the pulse, though some have referred part of its beneficial operation to its influence over the absorbent system. Inflammation, of a chronic kind, may be going on in one part of the body, to an extent sufficient to produce complete disorganization, and ultimately to cause the death of the patient, without the action of the larger arterial trunks (*i. e.* of

¹ *Lond. Med. Gaz.* vol. i. p. 744.

the system generally) being remarkably increased. In such cases, digitalis is, for the most part, of little use. Again, in violent and acute inflammation, accompanied with great excitement of the general circulation, especially in plethoric subjects, foxglove is, in some cases, hurtful; in others, it is a trivial and unimportant remedy; and we therefore rely, in our treatment, on bloodletting, and other powerful antiphlogistic measures; and foxglove, if serviceable at all, can only be used after the other means.

As a remedy for inflammation, foxglove is principally useful in less violent cases, particularly when accompanied with increased frequency of pulse, and occurring in subjects not able to support copious evacuations of blood. Moreover, it has more influence over inflammation of some parts of the body (as the arachnoid membrane, the pleura, the pericardium, and the lungs) than of others. In gastric and enteric inflammation, it would appear to be objectionable on account of its irritant properties; while its specific influence over the brain would make it a doubtful remedy in phrenitis. In arachnitis of children it is certainly a most valuable agent.

In conclusion, then, it appears that digitalis, as a remedy for inflammation, is principally valuable where the disease has a tendency to terminate in serous effusion. But in no case can it be regarded as a substitute for bloodletting. Its powers as an antiphlogistic remedy have, I suspect, been greatly overrated.

3. *Dropsy*.—Of all remedies for dropsy, none have gained more, and few so much, celebrity as foxglove. It has been supposed to owe its beneficial operation to its repressing arterial excitement, to its promoting the functions of the absorbent vessels, and particularly to its diuretic effects. Whatever may be its *modus operandi*, its powerful and salutary influence in many dropsies cannot be a matter of doubt. Dr. Withering has observed, that “it seldom succeeds in men of great natural strength, of tense fibre, of warm skin, of florid complexion, or in those with a tight and cordy pulse.” “On the contrary, if the pulse be feeble or intermitting, the countenance pale, the lips livid, the skin cold, the swollen belly soft and fluctuating, or the anasarcaous limbs readily pitting under the pressure of the finger, we may expect the diuretic effects to follow in a kindly manner.” In those with a florid complexion, bloodletting and purgatives will often be found useful preparatives for foxglove. In some forms of dropsy, foxglove is more serviceable than in others. Thus, anasarca, ascites, hydrothorax, and phlegmasia dolens, are sometimes benefited by it; whereas ovarian dropsy and hydrocephalus are not relieved by it. Its diuretic effect is greatly promoted by combining other diuretics with it, especially squills (as in the *Pilulæ Digitalis et Scillæ*, Ph. Ed.), calomel, or the saline diuretics (as the acetate of potash). A combination of vegetable bitters (as infusion of gentian or calumba) with foxglove, forms, I think, a valuable form of exhibition in many old dropsical cases. Infusion of common broom (*Cytisus scoparius*) might probably be advantageously conjoined with foxglove, where a powerful diuretic is required. In old cases of general dropsy, in œdematous swellings from debility, and in anasarca following scarlet fever, where, together with weakness, there is still left an excited and irritable state of the arterial system, chalybeates (as the *tinctura ferri sesquichloridi*) may be conjoined with foxglove, with the happiest effects.¹

4. *In Hemorrhages*.—In active hemorrhages from internal organs, accompanied with a quick, hard, and throbbing pulse, foxglove as a sedative is oftentimes serviceable. Epistaxis, hæmoptysis, and menorrhagia, are the forms of hemorrhage more frequently benefited by the use of foxglove.

5. *Diseases of the Heart and Great Vessels*.—An important indication in the treatment of many diseases of the heart and great vessels is to reduce the force and velocity of the circulation. The most effectual means of fulfilling this indication are—the adoption of a low diet, repeated bloodletting, and the employment of foxglove. There are, perhaps, no diseases in which the beneficial effects of foxglove

¹ Holland, *Med. Notes and Reflect.* p. 546.

are more marked than in those of the heart and great vessels. In *aneurism of the aorta*, our only hope of cure is by the coagulation of the blood in the aneurismal sac, and the consequent removal of the distensive pressure of the circulation. To promote this, we endeavour to retard the movement of the blood within the sac, by diminishing the quantity of blood in the system generally, and by reducing the force and velocity with which it circulates. Bloodletting and digitalis are, in these cases, very important agents; and under their use cases now and then recover. Again, in *simple dilatation* of the cavities of the heart, our objects are to remove, if possible, the cause (usually obstruction in the pulmonic or aortic system), to strengthen the muscular fibres of the heart, and to repress any preternatural excitement of the vascular system. Digitalis is useful to us in attaining the latter object. In *simple hypertrophy* or *hypertrophy with dilatation*, we have to reduce the preternatural thickness of the heart's parietes, and this we do by removing, when it can be done, any obstruction to the circulation, by using a low diet, by repeated bloodletting, and by the employment of foxglove. No means, says the late Dr. Davies,¹ excepting the abstraction of blood, diminishes the impulsion of the heart so completely and so certainly as digitalis. "I have been," adds he "in the habit of using it for several years for these affections, and have rarely seen it fail in producing at least temporary relief." "The enlarged and flaccid heart," observes Dr. Holland,² "though, on first view, it might seem the least favourable for the use of the medicine, is, perhaps, not so. At least we have reason to believe, that, in dropsical affections, so often connected with this organic change, the action of digitalis, as a diuretic, is peculiarly of avail." In *some disordered conditions of innervation of the heart and great vessels*—as in *angina pectoris*, nervous palpitation of the heart, and augmented arterial impulsion, foxglove is also at times beneficial. In patients affected with an intermittent or otherwise irregular pulse, I have several times observed this medicine produce regularity of pulsation;—a circumstance also noticed by Dr. Holland. Besides the preceding, there are *various other affections of the heart* in which foxglove may be found serviceable, either by its sedative influence over the circulation, or by its power of relieving dropsical effusion through its diuretic property.

6. *In Phthisis*.—Digitalis has been declared capable of curing pulmonary consumption, and numerous cases of supposed cures have been published. Bayle³ has collected from the writings of Sanders,⁴ Kinglake, Fowler, Beddoes,⁵ Drake, Mossman,⁶ Maclean, Ferriar,⁷ Magennis, Moreton, and others, reports of 151 cases treated by foxglove. Of these, 83 are said to have been cured, and 35 relieved. But a more accurate and extended experience has fully proved that this medicine possesses no curative, and very slightly palliative powers in genuine phthisis: it is totally incapable of preventing or of causing the removal of tubercular deposits, and has little, if any influence, in retarding the progress of consumption. Its power of diminishing the rapidity of the circulation cannot be doubted; but this effect is, as Dr. Holland⁸ justly remarks, "of less real moment than is generally supposed."

7. *In Insanity and Epilepsy*.—In these maladies foxglove may prove occasionally serviceable by repressing excessive vascular excitement, which sometimes accompanies them. Furthermore, the specific influence of this remedy over the cerebro-spinal system may now and then contribute to the beneficial operation of foxglove. But the precise nature of this influence not having as yet been accurately ascertained, while the pathology of the above-mentioned diseases is involved in considerable obscurity, it follows that the therapeutic value of this influence can only be ascertained empirically. In insanity, Dr. Hallaran⁹ recommends foxglove to reduce vascular action after the employment of depletion and purgation. It has

¹ *Lond. Med. Gaz.* vol. xv. p. 790.

² *Ibidl. Therap.* t. iii. p. 362.

³ *Observations on the Management of the Consumptive*, 1801.

⁴ *Essay to elucidate the Nat. Orig. and Connex. of Scroph. and Gland. Consumption*.

⁵ *On Digitalis*.

⁶ *Inquiry, &c. with Observ. on the Cure of Insanity*, 1810.

⁷ *Med. Notes and Reflect.* p. 574.

⁸ *Op. ante cit.*

⁹ *Op. cit.* p. 551.

been used in this disease, with success, by Dr. Currie,¹ and by Fanzago.² In epilepsy it is, I conceive, less likely to be serviceable, because this disease is less frequently accompanied with the vascular excitement, against which foxglove is most successful. Accordingly, while in some cases it has appeared to act beneficially,³ in others it has either been unsuccessful,⁴ or has only given temporary relief.⁵

8. *In various other diseases.*—Besides the preceding, there are several other maladies against which foxglove has been employed with occasional benefit, as *serpifera*⁶ and *asthma*.⁷ For other diseases relieved by foxglove I must refer the reader to the works of Murray⁸ and Bayle.⁹

ADMINISTRATION.—The ordinary dose of foxglove, *in powder*, is from gr. ss to gr. iss, repeated every six hours.

ANTIDOTES.—In a case of poisoning by foxglove, or its preparations, expel the poison from the stomach by the stomach-pump or by emetics, if vomiting should not have already commenced; assist the vomiting, when it is established, by the use of diluents; and counteract the depressing influence of the poison on the circulation by the use of ammonia and brandy; and keep the patient in a recumbent posture, to guard against syncope. I am unacquainted with any chemical antidote for foxglove; perhaps infusion of nutgalls might prove serviceable by the tannic acid which it contains.

1. INFUSUM DIGITALIS, L. E. D. [U. S.]; *Infusion of Foxglove*.—(Foxglove leaves, dried, ʒj [ʒij, *E.*]; [Spirit of Cinnamon fʒj, *L.*, fʒij, *E.*]; Boiling [distilled, *L.*] Water Oj [fʒxxviii, *E.*; ʒix, *D.*]. Macerate the foxglove leaves in the water for four [one, *D.*] hours, in a vessel lightly covered, and strain [through linen or calico, *E.*]; then add the spirit.—[The *U. S. Pharm.* directs Foxglove ʒi; Boiling Water Oss; Tincture of Cinnamon fʒi. Macerate the foxglove with the water for two hours in a covered vessel and strain, then add the tincture of cinnamon].—I believe this, when properly made, to be the most effectual of the preparations of foxglove. The dose of it is from fʒss to fʒj, repeated every six hours. I have known it given to the extent of fʒij.

2. TINCTURA DIGITALIS, L. E. D. [U. S.]; *Tincture of Foxglove*.—(Foxglove leaves, dried [in moderately fine powder, *E.*; in coarse powder, *D.*], ʒiv [ʒv, *D.*]; Proof Spirit [Diluted Alcohol, *U. S.*] Oij. Macerate for seven [fourteen, *D.*] days, then express and strain. "This tincture is best prepared by the process of percolation, as directed for the tincture of capsicum. If forty fluidounces of the spirit be passed through, the density is 944 [0.944], and the solid contents of a fluidounce amount to twenty-four grains. It may also be made by digestion," *E.*)—The usual dose of this preparation, for an adult, is ℥x, cautiously increased to ℥xl, repeated every six hours. I usually begin with ℥xx. The largest dose I have employed is fʒj; but, as I have already stated, it has been given to the extent of one ounce! The colour of this preparation is somewhat affected by exposure to strong solar light.

SUCCUS DIGITALIS.—The preserved juice of foxglove may be employed as a substitute for the tincture. From 1 cwt. 2 qrs. 26 lbs. of digitalis gathered in May, 49 pints of juice have been obtained.

3. EXTRACTUM DIGITALIS, E.; *Extract of Foxglove*.—"This extract is best prepared from the fresh leaves of digitalis, by any of the processes indicated for extract of conium," *E.*)—Recently introduced into the pharmacopœia of Edinburgh. Its preparation requires very great care and attention, or the virtues of the plant may be destroyed during the process. Dose, gr. j, cautiously increased.

¹ *Mem. of the Med. Soc. of London*, vol. iv.

² Quoted by Bayle, *Bibl. Thérap.* t. iii. p. 320.

³ Scott, *Ed. Med. and Surg. Journ.* Jan. 1827; Dr. E. Sharkey, *On the Efficacy of Digitalis in the Treatment of Idiopathic Epilepsy*, 1841.

⁴ Percival, *Ibid.* vol. ix. p. 274.

⁵ Currie, *op. supra cit.*

⁶ Haller, Merz, Schiemann, and Hufeland, quoted by Bayle, *Bibl. Thérap.* t. iii. p. 369.

⁷ Ferriar, *On Digitalis*, 1799; Fogo [asthma cured by an overdose of foxglove], *Ed. Med. and Surg. Journ.* vol. xviii. p. 345.

⁸ *App. Med.* vol. i.

⁹ *Op. supra cit.*

4. PILULÆ DIGITALIS ET SCILLÆ, E.; *Pills of Foxglove and Squill*.—(*Digitalis*; *Squill*, of each *one part*; *Aromatic Electuary two parts*. Beat them into a proper mass with conserve of red roses; and divide the mass into four-grain pills.)—A valuable diuretic compound. Used in dropsies. Dose, one or two pills.

ORDER XLII. SOLANACEÆ, *Lindley*.—NIGHTSHADES.

SOLANEE, *Jussieu*.

CHARACTERS.—*Calyx* 5-parted, seldom 4-parted, persistent, inferior. *Corolla* monopetalous, hypogynous; the limb 5-cleft, seldom 4-cleft, regular, or somewhat unequal, deciduous; the aestivation plaited or imbricated. *Stamens* inserted upon the corolla, as many as the segments of the limb, with which they are alternate; *anthers* bursting longitudinally, rarely by pores at the apex. *Ovary* 2-celled, composed of a pair of carpels right and left of the axis, rarely 4—5 or many-celled, with polyspermous placenta; *style* continuous; *stigma* simple; *ovules* numerous, amphitropal. *Pericarp* with 2 or 4 or many cells, either a capsule with a double dissepiment parallel with the valves, or a berry with the placenta adhering to the dissepiment. *Seeds* numerous, sessile; *embryo* straight or curved often out of the centre, lying in a fleshy *albumen*; *radicle* next the hilum. *Herbaceous* plants or *shrubs*. *Leaves* alternate, undivided, or lobed, sometimes collateral; the floral ones sometimes double, and placed near each other. *Inflorescence* variable, often out of the axil; the *pedicels* without bracts (*Lindley*).

PROPERTIES.—The narcotic properties which many members of this order possess depend on the presence of vegetable alkaloids; but the narcotism which they induce is very different to that caused by opium; ¹ *hyoscyamus*, *belladonna*, and *stramonium*, give rise to phantasms and dilatation of the pupil (see the *Solanacea mydriatica*, vol. i. p. 237); *nicotiana* is a nauseating cardio-vascular sedative (see *ante*, pp. 237 and 258). An acrid resin is found in many species; on this the hot, pungent, burning qualities of capsicum depend. A bitter principle confers on some species (as *S. Pseudoquina* and *crispum*) tonic properties. Starch abounds in potatoes, which owe their nutritive qualities chiefly to it.

171. HYOSCYAMUS NIGER, *Linn.*—COMMON HENBANE.

Sec. Syst. Pentandria, Monogynia.

(*Herbæ biennis. Folium caulinum recens et exsiccatum, L.*—*Leaves, E. D.*)

HISTORY.—This plant is the *ῥοσκόμος μέλας* of Dioscorides,² the *hyoscyamus niger* of Pliny.³

BOTANY. **Gen. Char.**—*Calyx* urceolate, 5-toothed. *Corolla* funnel-shaped; the limb plaited, 5-lobed; the lobes obtuse, unequal. *Stamens* 5, inserted in the lower part of the tube of the corolla, inclosed or exserted, declinate; *anthers* dehiscing longitudinally. *Ovary* 2-celled; placenta fixed to the dorsal dissepiment; *ovules* numerous; *style* simple; *stigma* capitate. *Capsule* inclosed by the persistent often enlarged calyx, narrowed from the ventricose base, membranous, 2-celled, circumscissile at the apex, with a 2-celled lid. *Seeds* many, kidney-shaped; *embryo* in fleshy albumen, almost peripheral, curved (*Endlicher*).

Sp. Char.—*Leaves* oblong, pinnatifid, or sinuate sessile, and subamplexicaule; lower leaves stalked. *Flowers* nearly sessile, axillary, unilateral (*Babington*).

Root spindle-shaped. *Stem* bushy. *Leaves* soft and pliant, sharply lobed. Whole herbage glandular, downy, and viscid, exhaling a powerful fetid and oppressive odour. *Flowers* numerous from the bosoms of the crowded upper leaves, drooping, almost entirely sessile, of an elegant straw colour, usually pencilled with dark purple veins.

Hab.—Indigenous; waste ground, banks, and commons. Flowers in July.

There are two varieties of this species; one biennial, the other annual. Both are cultivated at Mitcham.

¹ The generalizations of some late French writers (Trousseau and Pidoux, *Traité de Thérap.* t. i. p. 266), with respect to the identity of the operation of the narcotic Solanæe, do not appear to me to be founded in fact.

² *Lib. iv. cap. 69.*

³ *Hist. Nat. lib. xxv. cap. 17, ed. Valp.*

Var. *a biennis*; Biennial Black Henbane.—This is larger, stronger, more branched, more clammy, than the annual variety. Its root is biennial. Cultivated at Mitcham. During the first year of its growth the plant has no aerial stem, all the leaves being radical and stalked. It is less odorous and clammy than the mature plant; and Dr. Houlton¹ states that it yields less extract. In the autumn the leaves die, but the root survives during the winter; and in the following spring sends up an aerial stem, which grows to the height of from two to four feet. The leaves of the second year are large, deeply sinuate, or pinnatifid. It flowers towards the end of May, or in June.

As this variety is more highly developed than the annual sort, it probably possesses more medicinal activity; and, therefore, should be preferred. I am, however, unacquainted with any experiments demonstrative of its superiority.

This variety flowers earlier than the annual sort. The surest plan of obtaining it, therefore, is to purchase it fresh while in flower.

Var. *β annua*, Sims, Bot. Mag. 2394; *H. agrestis*, Kitaibel ex Schult. Fl. Austr., ed. 2, p. 383; *H. niger*, var. *β minor*, Brandt u. Ratzeburg, Deutschl. phan. Gütgewächse; *H. niger*, var. *β agrestis*, Nees in Linn. Trans. xvii. 77; *Annual or Field Henbane*.—Root annual; stem simple, downy; leaves smoothish, sinuately toothed; flowers sessile; corolla reticulated.—Indigenous; South of Europe; North of India.—Cultivated at Mitcham for medicinal use.—Flowers in July and August.

The plant is smaller, the leaves less deeply sinuated (not pinnatifid), less hairy, clammy, and fetid than var. *a biennis*.

* *Corolla non violaceo reticulata*; *H. pallidus*, Koch; Babing. Man., of Br. Botany.—This is a subvariety of *β annua*, with yellow corolla, without any purple veins. It is said to grow wild at Esher, in Surrey.

HYOSCYAMUS ALBUS, Linn. Ὑοσκιάμος λευκός, Diosc. lib. iv. cap. 69.—Leaves petiolate; lower ones orbicular, entire; the rest from cordate to ovate at the base, sinuated; flowers sessile.—South of Europe. Annual. Its medicinal properties resemble those of *H. niger*, for which it has sometimes been employed in medicine.²

DESCRIPTION.—The herb (*herba hyoscyami*), when fresh, has a strong, unpleasant, narcotic odour, a mucilaginous, slightly acrid taste, and a clammy feel. It should be gathered when in full flower. By drying, it almost wholly loses these properties. One hundred pounds of the fresh herb yield about fourteen pounds when dried.³ The leaves (*folia hyoscyami*), when fresh, are pale dull green. The seeds (*semina hyoscyami*) are small, compressed, uniform, roundish, finely dotted, of a yellowish-gray colour, and have the odour of the plant, and an oleaginous, bitter taste.

Sessile, oblong, acutely sinuated, somewhat pubescent, with viscid fetid hairs.

It is to be gathered and dried as ordered for foxglove. The herb which grows wild in waste places is to be preferred to that which is cultivated in gardens, *L*.

COMPOSITION.—The seeds of *Hyoscyamus niger* were analyzed in 1816 by Kirchof,⁴ and in 1820 by Brandes.⁵ The extract of the herb was analyzed by Lindbergson.⁶

Brandes's Analysis.

Fatty oil	24.2
Waxy fat	1.4
Resin insoluble in ether	3.0
Malate of hyoscyamina with malates of lime and magnesia, and a salt of potash and ammonia	6.3
Uncrystallizable sugar	a trace
Gum 1.2, bassorin 2.4, and starch 1.5.	5.1
Albumen	4.5
Vegeto-animal matter	3.4
Malate, phosphate, sulphate, and muriate of potash	0.4
Malates of lime and magnesia	0.6
Phosphates of lime and magnesia	2.4
Woody fibre	26.0
Water	24.1

Seeds of *hyoscyamus* 101.4

Lindbergson's Analysis.

Narcotic extractive soluble in water and alcohol.
Bitter extractive.
Gummy extractive.
Malates, phosphates, sulphates, and muriates of magnesia.

Extract of the herb.

The ashes contained carbonate, phosphate, sulphate, and muriate of potash, carbonate and much phosphate of lime, much silica, manganese, iron, and minute traces of copper.

¹ *Pharmaceutical Journal*, vol. iii. p. 578, 1844.

² Fouquier, *Archiv. Gén. de Méd.* Mars, 1-23; Chevallier, *Journ. de Chim. Méd.* t. ii. p. 36.

³ Martius, *Pharmakogn.*

⁴ *Ibid.* Bd. xxi. S. 250.

⁵ *Berl. Jahrb.* Bd. xvii. S. 144.

⁶ Guélin, *Handb. d. Chem.* ii. 1363.

1. **HYOSCIAMIA OR HYOSCIAMINA.**—This term has been applied to a vegetable alkali procured from the seeds and herbs of *Hyoscyamus niger* by Brandes,¹ whose statements have been confirmed by Geiger and Hesse, as well as by Mein.² However, Chevallier, as well as Brault and Poggiale,³ have failed to procure it. The properties assigned to it are almost identical with those of *Atropina*, from which it differs in being more soluble in water. It is crystallizable, has an acrid taste, and, when volatilized, yields ammonia. Reisinger⁴ says, that a drop of a solution of one grain of this substance in ten grains of water caused dilatation of the pupil, but did not give rise to irritation of the eye. A solution of double this strength acted as an irritant.

2. **EMPYREUMATIC OIL OF HENBANE** (*Pyro-Hyoscyamia?*).—This was obtained by Dr. Morries⁵ by the destructive distillation of henbane. Its chemical properties are identical with those of the empyreumatic oil of foxglove. It proved a powerful narcotic poison.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Water holding in solution extract of henbane proved poisonous to *Hyoscyamus niger*.⁶

β. On Animals.—Its effects on herbivorous animals are slight. Given to horses in large quantities, it causes dilatation of the pupils, spasmodic movements of the lips, and frequency of pulse.⁷ On dogs its effects appear to be analogous to those on man.⁸ It does not cause any local irritation. Its constitutional effects are dilatation of pupil, weakness of the posterior extremities, staggering, and insensibility.

γ. On Man.—In small and repeated doses, henbane has a calming, soothing, and tranquillizing effect. This is especially observed in persons suffering with great nervous irritability, and with a too active condition of the sensorial functions. In such it frequently causes quietude, with a tendency to sleep. It frequently allays irritation and preternatural sensibility existing in any organ. It does not quicken the pulse, check secretion, or cause constipation. Large doses sometimes induce sleep. Fouquier,⁹ however, denies this. He says henbane causes headache, giddiness, dimness of sight, dilatation of pupil, a greater or less tendency to sleep, and painful delirium. In some cases these symptoms are followed by thirst, nausea, griping, and either purging or constipation; and in a few instances febrile heat and irritation of skin are induced. But I have frequently seen sleep follow its use, though its hypnotic properties are neither constant nor powerful. It more frequently fails to occasion sleep in those accustomed to the use of opium. Very large doses are apt to be followed by delirium rather than by sleep. Its power of alleviating pain and allaying spasm is greatly inferior to that of opium. In poisonous doses it causes loss of speech, dilatation of pupil, disturbance of vision (presbyopia), distortion of face, coma, and delirium, generally of the unmanageable, sometimes of the furious kind, and phantasms; and paralysis, occasionally with convulsive movements. Irritation of the stomach and bowels (manifested by nausea, vomiting, pain, and purging) is occasionally induced.¹⁰ One author¹¹ says *hyoscyamus* renders the hair gray, while another¹² states that it darkens it.

In its operation on the body, henbane presents several peculiarities (see vol. i. p. 237). From opium it is distinguished by the sedative rather than stimulant effects of small doses; by its not confining the bowels; by the obscurity of vision (presbyopia); and when swallowed in large doses, by its producing dilatation of the pupil, and by its being more apt to occasion delirium with phantasms. Furthermore, in some individuals opium causes headache and other distressing symptoms which henbane is not so apt to produce. From belladonna and stramonium, to which it is in several respects closely allied, it is distinguished by the very rare occurrence of any symptoms of gastro-intestinal irritation after the ingestion of large doses of it. Sundelin¹³ says "that it wants the resolvent operation and the stimu-

¹ *Pharm. Central-Blatt für 1822*, S. 479.

² *Journ. de Pharm.* t. xx. p. 87; and *Pharm. Central-Blatt für 1835*, S. 83.

³ *Journ. de Pharm.* t. xxi. p. 131.

⁴ *Ed. Med. and Surg. Journ.* vol. xxxix. p. 379.

⁵ *Arch. Gén. de Méd.* t. xviii. p. 301.

⁶ Macaire, quoted by De Candolle, *Phys. Veg.* p. 1351; also Miguel, quoted in Meyen's *Report on the Progress of Vegetable Physiology during the year 1837*, translated by W. Francis, p. 139.

⁷ Moreoud, *Pharm. Vet.* p. 349; see also Viborg, in *Wibmer's Werk, d. Arzn. u. Gift.* Bd. iii. S. 156.

⁸ *Orfila, Tox. Gén.*

⁹ *Arch. Gén. de Méd.* t. i. p. 297.

¹⁰ For abstracts of cases illustrative of these effects, consult Orfila, *Toxicol. Gén.*; and Wibmer, *Wirk. d. Arzn. u. Gift.*

¹¹ Hufschmidt, quoted by Wibmer, *op. cit.* S. 148.

¹² Most, *Encycl. der gesamm. med. u. chir. Praxis*, art. *Cosmetica*, Bd. i. S. 198. Leipzig, 1-36.

¹³ *Handb. d. sp. Heilm.* Bd. i. S. 463, 3te Aufl.

has scarcely any effect (perhaps a slight turbidness) when added to the decoction or to the tincture diluted with water.

(By the action of sulphuric or hydrochloric acid on the tincture or decoction of foxglove, I have not been able to detect the presence of digitaline.)

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Marcet¹ found that a solution of the watery extract of foxglove killed a haricot plant (*Phaseolus vulgaris*) in twenty-four hours.

β. On Animals generally.—The effects of foxglove have been tried on dogs,² horses, rabbits,³ turkeys,⁴ the domestic fowl, and frogs; and on all it has been found to act as a poison. One drachm of the powder may be given to horses as a sedative in inflammation.⁵ Two ounces have produced death in twelve hours.⁶ According to the experience of Orfila, the first symptoms of poisoning observed in [carnivorous] animals is vomiting. The influence of the poison over the heart does not appear to be uniform; for in some cases he found the pulsations of this viscus unaltered, in others accelerated, while occasionally they were retarded. In the horse killed by two ounces of foxglove, the pulse was 130 per minute, a short time before death (Moiroud)—the standard pulse of the horse being 40 or 42 per minute. The cerebro-spinal symptoms observed in animals, are diminished muscular power, convulsive movements, tremors, and insensibility. The powder acts as a local irritant, giving rise to inflammation of parts to which it is applied (Orfila).

γ. On Man.—We may, for convenience, establish three degrees of the operation of foxglove.

In the first degree, or that produced by *small and repeated doses*, foxglove sometimes affects what are termed the organic functions, without disordering the animal or cerebro-spinal functions. Thus we sometimes have the stomach disordered, the pulse altered in frequency, and sometimes also in fulness and regularity, and the secretion of urine increased, without any other marked symptoms. The order in which the symptoms just mentioned occur is not uniform; sometimes the diuresis, at others nausea, and occasionally the affection of the circulation, being the first obvious effect.

The influence of foxglove over the circulation is not at all constant. In some cases the frequency of the pulse is augmented, in others decreased, while in some it is unaffected. Lastly, in a considerable number of instances, the pulse becomes irregular or intermittent under the use of foxglove.⁷ A few drops of the tincture will, in some cases, reduce the frequency of the pulse, and render it irregular and intermittent, while in other instances much larger doses may be taken without any obvious effect on it. Dr. Withering⁸ mentions one case in which the pulse fell to 40; and I have several times seen it reduced to 50. In some cases the slowness of the pulse is preceded by an increased activity of the vascular system. From Sandras's reports⁹ this would appear to occur more frequently after small than large doses of foxglove. Dr. Sanders,¹⁰ indeed, asserts that foxglove invariably excites the pulse, and refers to an experience of 2000 cases in proof. He says, that he has seen the pulse rise from 70 to 120 under the use of foxglove, and at the end of twenty-four hours, or sooner, fall with greater or less rapidity to forty, or even below this. But an experience of the use of foxglove, in only twenty cases, will, I believe, convince most persons that Dr. Sanders has fallen into an error in the sweeping assertion which he has made. A great deal, however, depends on the position of the patient. If it be desired to reduce the frequency of the pulse, the patient should be kept in a recumbent posture. The important influence of posture was first pointed out, I believe, by Dr. Baidon.¹¹ His own pulse, which had been reduced by this plant from 110 to 40 beats per minute while he was in the recum-

¹ *Ann. de Chim. et de Phys.* vol. xxix. p. 200.

² Le Roger, *Bibl. Univ.* June, 1821.

³ Youatt, *The Horse*, in *Libr. of Usef. Knowledge*.

⁴ See the statistical *resumé* of Sandras, *Bull. de Thérap.* t. vi.

⁵ *Account of the Foxglove*, p. 73, 1785.

⁶ *Treat. on Pulm. Consumption*, ed. 1808.

⁷ Orfila, *Toxicol. Gén.*

⁸ Salerne, *Hist. de l'Acad. des Scien.* p. 84, 1748.

⁹ Moiroud, *Pharm. Véter.* p. 354.

¹⁰ *Op. cit.*

¹¹ *Ed. Med. and Surg. Journ.* vol. iii. p. 270.

bent position, rose to 70 when he sat up, and to 100 when he stood. We have a ready explanation of this fact. In a state of health, the pulsations of the heart are more frequent (usually to the extent of five or six in the minute) in the erect than in the horizontal position; and it is very obvious that greater force is required to carry on the circulation in the former than in the latter, since, in the erect position, the heart and arteries have to send blood to the head against gravity. Now, the power of the heart being enfeebled by foxglove, when a demand is made on this viscus for an increase in the force of contractions by the change from the recumbent to the standing attitude, it endeavours to make up for its diminished force by an increase in the frequency of its contractions. I need scarcely add, that the sudden change of position in those who are much under the influence of this medicine, is attended with great danger, and in several instances has proved fatal; for, in consequence of the heart not having sufficient power to propel the blood to the head against gravity, fatal syncope has been the result.¹ The influence of digitalis over the pulse is more marked in some individuals or cases than in others; thus the reduction of the frequency of the pulse is in general more readily induced in weak and debilitated constitutions, than in robust and plethoric ones. Occasionally, no obvious effect on the number, force, or regularity of the pulse is produced, though the foxglove may be given to an extent sufficient to excite vomiting and cerebral disorder. Shroek² experienced, from two grains of foxglove, nausea, headache, small, soft, and quick pulse, dryness of the gums and throat, giddiness, weakness of limbs, and increased secretion of saliva. Some hours after, he observed sparks before the eyes, his vision became dim, and he experienced a sensation of pressure on the eyeballs.

A most important fact connected with the repeated uses of small doses of it, is the *cumulative effect* sometimes observed. It has not unfrequently happened that, in consequence of the continued use of small doses of this medicine, very dangerous symptoms, in some cases terminating in death, have occurred. The most prominent of these were great depression of the vascular system, giddiness, want of sleep, convulsions, and sometimes nausea and vomiting.³ A knowledge of its occasional occurrence impresses us with the necessity of exercising great caution in the use of this remedy, particularly with respect to the continuance of its administration and increase of dose; and it shows that, after the constitutional effect has become obvious, it is prudent to suspend from time to time the exhibition of the remedy, in order to guard against the effects of this alarming accumulation. I may add, however, that I have used it, and seen others employ it, most extensively, and in full doses, and have rarely seen any dangerous consequences; and I believe, therefore, the effects of accumulation to be much less frequent than the statements of authors of repute would lead us to expect. The experience of Dr. Holland⁴ is to the same effect. "Though employing the medicine somewhat largely in practice," he observes, "I do not recollect a case in which I have seen any injurious consequences from this cause."

The diuretic operation for which we employ foxglove is very inconstant. Dr. Withering stated that this medicine more frequently succeeds as a diuretic than any other, and that if it fail, there is but little chance of any other remedy succeeding. My experience, however, is not in accordance with Dr. Withering's. I have frequently seen foxglove fail in exciting diuresis, and have often found the infusion of common broom (*Urtica scoparius*) subsequently succeed. It has been asserted by some, that the diuretic effect of foxglove was only observed in dropsical cases, and that it, therefore, depended on the stimulus given to the absorbent vessels, and not to any direct influence exerted over the kidneys; but the statement is not true,

¹ For some interesting remarks on the *Effects produced by Posture on the Pulse*, by Dr. Graves, consult *Dubl. Hosp. Rep.* vol. x. p. 561.

² Quoted by Wibmer, *Wirk. d. Arzney u. Gifte*, Bd. ii. S. 311.

³ See the cases published by Dr. Withering, *op. cit.*; also a fatal case recorded by Dr. Blackall, *On Dropsy*, p. 175, 4th ed.

⁴ *Med. Notes and Reflections*, p. 544.

time to time to keep the powder covered. Cease to filter when the liquid which passes begins to produce a precipitate as it falls. Distil off the alcohol from the filtered liquor, and evaporate the residue to the proper consistence.)—This preparation is intended as a substitute for the preceding, as the fresh herb cannot be obtained in sufficient quantity in the United States. It is a fine, clear, dark, shining extract, is possessed of the active properties of the drug, and may be employed in lieu of the common extract. The dose is gr. j to gr. v, or larger quantities if required.]

172. ATROPA BELLADONNA, Linn.—COMMON DWALE; DEADLY NIGHTSHADE.

Sex. Syst. Pentandria, Monogynia.

(*Atropia*; alkali e radice comparatum crystalli; *Folium recens et exsiccatum*, L.—Leaves, E.—The leaves and root, D.)

HISTORY.—Belladonna, being a native of both Greece and Italy, was doubtless known to, and described by, the ancient Greek and Roman writers. Modern botanists, however, have been unable to identify it with certainty. Fraas¹ is of opinion that it is the *Μανδραγόρας* of Theophrastus,² the *Στρυχνος μανικός* (“*ανθος μέλαν*”) of Dioscorides,³ the third sort of *Strychnos* (Solanum) of Pliny.⁴ But this notion is not without its difficulties. The plant which Theophrastus mentions under the above name had a stem like the *ράβδος* (*ferula*), and a black racemose fruit with a vinous taste. Now the stem of belladonna certainly does not resemble that of an umbelliferous plant, nor is the fruit racemose. Sibthorp and Smith⁵ have, in my opinion, only exercised a proper precaution in not assigning any ancient synonyme to belladonna.

The earliest undoubted notice of belladonna occurs in the work of Tragus (A. D. 1532), who calls it *Solanum hortense nigrum*.⁶ It has been supposed that it was this plant which produced such remarkable and fatal effects on the Roman soldiers during their retreat from the Parthians.⁷ Buchanan⁸ relates that the Scots mixed the juice of this plant with the bread and drink, which, by their truce, they were to supply the Danes, which so intoxicated them, that the Scots killed the greatest part of Sweno's army while asleep. Shakspeare⁹ is supposed to allude to it under the name of the *insane root*.

BOTANY. **Gen. Char.**—*Calyx* 5-parted. *Corolla* hypogynous, funnel-shaped, campanulate; the limb plaited, 5—10-cleft. *Stamens* 5, inserted into the lower part of the corolla, exserted, or nearly so; filaments filiform; anthers dehiscing longitudinally. *Ovary* 2-celled; placentæ inserted in a line on the dorsal dissepiment; ovules numerous; *style* simple; *stigma* peltato-depressed. *Berry* supported by the spreading calyx, 2-celled. *Seeds* many, subreniform; *embryo* in fleshy albumen, subperipheral, arched or annular (Endlicher).

Sp. Char.—*Stem* herbaceous. *Leaves* broadly-ovate, entire. *Flowers* solitary, axillary on short stalks (C. C. Babington).

Root fleshy, creeping. Whole plant fetid when bruised, of a dark and lurid aspect, indicative of its deadly narcotic quality. *Stems* herbaceous, 3 feet high, round, branched, leafy, slightly downy. *Leaves* lateral, mostly 2 together of unequal size, ovate, acute, entire, smooth. *Flowers* imperfectly axillary, solitary, stalked, drooping, dark full purple in the border, paler downwards, about an inch long. *Berry* of a shining violet black, the size of a small cherry, sweetish, and not nauseous (Smith).

Hab.—Indigenous; hedges and waste ground, on a calcareous soil. *Flowers* in June.

¹ *Synops. Plant. Fl. Class.* p. 166, 1845.

² *Lib. iv.* cap. 71.

³ *Prod. Fl. Græcæ.*

⁴ See Plutarch's *Life of Antony*.

⁵ *Macbeth*, Act i. Scene 3d.

⁶ *Hist. Plant.* lib. vi. cap. 2.

⁷ *Lib. xxi.* cap. 105; and lib. xxviii. cap. 10; ed. Valp.

⁸ Bauhin, *Pinar.*

⁹ *Rerum Scot. Hist.* lib. vii.

DESCRIPTION.—The root (*radix belladonnæ*), when fresh, is one or more inches thick, and sometimes a foot or more long; it is branching, fleshy, internally white, externally grayish or brownish-white. Its taste is slight, sweetish; its odour feeble. It may be collected in the autumn or early in the spring. The flowering stems (*herba belladonnæ*) are collected in June or July; they are then deprived of leaves (*folia belladonnæ*), which are to be carefully dried. The leaves, when fresh, have a feeble, bitterish, sub-acid taste.

Oval, acute, quite entire, smooth, when bruised evolves an unpleasant odour.

The herb which grows spontaneously in hedges and uncultivated places is to be preferred to that cultivated in gardens.—*Ph. Lond.*

COMPOSITION.—The leaves of belladonna were analyzed, in 1808, by Melandri;¹ the expressed juice, in 1809, by Vauquelin;² and the dried herb, in 1819, by Brandes.³ Besides these, there have been several less complete examinations of this plant by other chemists, which have yielded more or less interesting results.

Brandes's Analysis.

Supermalate of atropia	1.51
Pseudo-toxin with malate of atropia and potash salts	16.05
Wax	0.70
Chlorophylle	5.84
Phytocolla (a nitrogenous substance insoluble in alcohol)	6.90
Gum	8.33
Starch	1.25
Albumen	10.70
Lignin	13.70
Salts	7.47
Water	25.50
Loss	2.05

Dried herb of Belladonna 100.00

1. **ATROPIA.**—(See p. 478.)

2. **PSEUDOTOXIN.**—A substance obtained by Brandes from the watery extract of belladonna. It is a brownish-yellow, soluble in water, insoluble in absolute alcohol and ether, is coloured green by the salts of iron, and is totally precipitated from its watery solution by the salts of lead, and by tincture of galls.⁴

3. **BELLADONNIN.**—Under this name, Luebekind⁵ has described a volatile vegetable alkali, which, he says, is distinct from atropia. It is crystallizable, and has an ammoniacal odour. It consists of carbon 28.5, hydrogen 22.4, nitrogen 32.1, oxygen 17.0. The crystals contain three equivalents of water. Two grains caused extreme heat in the throat, and constriction of the larynx.

4. **ATROPIC ACID.**—This name has been given by Richter⁶ to a volatile, crystallizable acid, distinguished from benzoic acid by its not precipitating the salts of iron.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—An aqueous solution of extract of belladonna is poisonous to plants.⁷

β. On Animals generally.—Belladonna proves poisonous to animals and birds; but much less so to herbivorous than to carnivorous animals. Eight pounds (Troy) of the leaves have been eaten by a horse without any ill effects.⁸ The late Mr. Anderson told me that the blackbirds eat the seeds at the Chelsea Garden with impunity. A pound of ripe berries has been given to an ass with very little effect.⁹ Given to dogs, belladonna causes dilatation of pupil, plaintive cries, efforts to vomit, weakness of the posterior extremities, staggering, frequent pulse, a state like intoxication, and death.¹⁰ Forty or fifty grains of the watery extract, injected into the jugular vein of dogs, have proved fatal.¹¹ Flourens¹² thinks that the *tubercula quadrigemina* are the parts of the nervous centres on which this poison specifically acts. His inferences were drawn from experiments made on birds. The topical action of belladonna is that of an acrid, though not a very violent one.¹³

¹ *Ann. de Chim.* lxxv. 222.

² *Gmelin's Hand. d. Chem.* ii. 1305.

³ *Pharm. Central-Blatt für 1839*, S. 448.

⁴ *Maurel, Ann. Chim. et Phys.* vol. xxix. p. 200; and Schübler and Zeller, *Schweigger's Journ. f. d. Chem.* 1827, Bd. 50, S. 64—66.

⁵ *Moreau, Pharm. Vet.* p. 344.

⁶ *Orfila, Toxicol. Gen.*

⁷ *Rech. Expér.* 1824.

⁸ *Ibid.* lxxii. 53.

⁹ *Ibid.* ii. 1032.

¹⁰ *Ibid.* für 1837, S. 614.

¹¹ Viborg, in *Wibmer, Wirk. d. Arz. u. Gifte*, Bd. i. S. 366.

¹² *Ibid.*

¹³ *Orfila, supra cit.*

γ. On Man.—In the first degree of its operation, belladonna diminishes sensibility and irritability. This effect (called by some *sedative*) is scarcely obvious in the healthy organism, but is well seen in morbid states, when these properties are preternaturally increased. A very frequent, and sometimes the earliest, obvious effect of belladonna is dryness of the mouth and throat, frequently attended with thirst. The other secretions and the circulation are oftentimes not affected, though occasionally they are augmented. Mr. Bailey¹ “asserts that belladonna affects neither the stomach nor bowels, nor any of the secretions nor excretions, those of the salivary glands excepted.” The asserted influence of belladonna over the organic functions is said to be shown by its power of inducing, in some cases, resolution of swellings and tumours of various kinds, as will be presently noticed.

In the second degree of its operation, belladonna manifests, both in healthy and morbid conditions, its remarkable influence over the cerebro-spinal system. It causes dilatation of the pupils (mydriasis), presbyopia, or long-sightedness, with obscurity of vision, or absolute blindness (amaurosis), visual illusions (phantasms), suffused eyes, occasionally disturbance of hearing (as singing in the ears, &c.), numbness of the face, confusion of head, giddiness, and delirium, which at times resembles intoxication, and may be combined with or followed by sopor. These symptoms are usually preceded by a febrile condition, attended with a remarkable affection of the mouth, throat, and adjacent parts. Besides dryness of these parts, it causes difficulty of deglutition and of articulation, a feeling of constriction about the throat, nausea, and sometimes actual vomiting, and, now and then, swelling and redness of the face. The pulse is usually hurried and small. The cutaneous, renal, and mucous secretions are frequently augmented. An exanthematous eruption, like that of scarlet fever, has been noticed; and irritation of the urinary organs, has in some instances occurred.²

In some cases very severe effects have been induced by the application of the extract to abraded surfaces.³ The continued application of it to the sound skin has also been attended with similar effects.⁴

In the third degree of its operation, belladonna produces effects similar to the preceding, but in a more violent form. The following are the symptoms experienced by above 150 soldiers, who were poisoned by the berries of belladonna, which were gathered at Pirna, near Dresden: “Dilatation and immobility of the pupil; almost complete insensibility of the eye to the presence of external objects, or at least confused vision; injection of the conjunctiva with a bluish blood; protrusion of the eye, which in some appeared as if it were dull, and in others ardent and furious; dryness of the lips, tongue, palate, and throat; deglutition difficult or even impossible; nausea not followed by vomiting; feeling of weakness, lipothymia, syncope; difficulty or impossibility of standing, frequent bending forward of the trunk; continual motion of the hands and fingers; gay delirium, with a vacant smile; aphonia or confused sounds, uttered with pain; probably ineffectual desires of going to stool; gradual restoration to health and reason, without any recollection of the preceding state.”⁵

Seven cases (two of which proved fatal) of poisoning by belladonna berries have occurred under my notice in the London Hospital; of these, a report has been published by Dr. Lethely.⁶ The phenomena were tolerably uniform. The following symptoms especially attracted my attention:—

1. *Dryness of the fauces.*—The excessive dryness of all the parts about the throat contributed greatly to the difficulty of swallowing and alteration of voice.

2. *Scarlet eruption.*—In several cases a scarlet eruption appeared on the arms and legs.

3. *Mydriasis and presbyopia.*—Mydriasis, or dilatation of the pupil, was present in every case; and was accompanied, in all the cases in which the patient was in a fit state for observation,

¹ *Observations Relative to the Use of Belladonna*, p. 9, 1818.

² Jolly, *Nouv. Méd.* iii. 1828; and *Lancet*, vol. i. p. 45, 1828-9.

³ Wade, *Med. and Phys. Journ.* vol. lvii. p. 286, 1827; Davies, *Lectures on Diseases of the Lungs and Heart*, p. 496.

⁴ Baco, *Lond. Med. and Phys. Journ.* vol. xxiv. p. 383, 1810.

⁵ Gaultier de Claubry, in Orfila's *Toxicol. Gén.*

⁶ *Pharmaceutical Times*, vol. i. p. 25, 1846.

with presbyopia, or long-sightedness. These two symptoms depend, as I have before stated (see vol. i. p. 245), on the paralyzing influence of belladonna on the muscular fibres of the iris, by which mydriasis is produced, and on the ciliary muscle, by which the adjusting power of the eye is impaired. I strongly suspect that the impaired vision which has been ascribed to the use of belladonna is chiefly or entirely presbyopia. In one of the patients (a woman) above alluded to, the vision was so much impaired that she could not see to read; and when I placed the prayer card in her hand, she held it upside down, and declared her inability to distinguish the letters or words on it. But after trying several pairs of spectacles, borrowed of patients and others in the ward, she found one (magnifiers) which enabled her to read with ease. This agrees with the results of experiments of Müller¹ on himself. This physiologist found that, by the local action of belladonna on one eye, he caused presbyopia of that eye, and thus gave rise to an unequal refractive power of the two eyes. Moreover, it accords with the effects experienced on his own person by Dr. Lobb, who informs me that he could see objects at a distance (as on the opposite side of the street), but could not distinguish a letter or a word in a book; but, by the aid of a magnifying-glass or powerful spectacles, he could read distinctly the smallest print.

4. *Delirium; Phantasms.*—The delirium was of the cheerful or wild sort, amounting in some cases to actual frenzy. In some of the patients it subsided into a kind of sleep attended with pleasant dreams, which provoked laughter. The delirium was attended with phantasms; and in this respect resembled that caused by alcohol (*delirium é potu*); but the mind did not run on cats, rats, and mice, as in the case of drunkards. Sometimes the phantasms appeared to be in the air, and various attempts were made to catch or chase them with the hands; at other times they were supposed to be on the bed. One patient (a woman) fancied the sheets were covered with cucumbers. The production of phantasms by belladonna was known to Linnaeus,² who calls this agent "*a phantastic*," (see *ante*, p. 237.)

5. *Convulsions; Paralysis; Sopor or Coma.*—In most of the cases, the power of the will over the muscles was so far disordered, that the muscular movements were somewhat irregular, causing a kind of staggering or jerking; but actual convulsions were not general. There was sopor, which terminated in coma, with a weakened or paralytic condition of the muscles.

The active principle of belladonna becomes absorbed and is thrown out of the urine, in which secretion both Runge and Dr. Letheby have detected it (see vol. i. p. 152, foot-note).

In comparing the operation of belladonna with that of other cerebro-spinals (see vol. i. p. 235), the most remarkable symptoms which attract our attention are the dilatation of the pupils, with insensibility of the irides to light, disturbance of vision (presbyopia), giddiness, staggering, the delirium (extravagant, pleasing, or furious), with phantasms, followed by sopor, and the remarkable affection of the mouth and throat (dryness of the throat, difficulty of deglutition and of articulation). Convulsions are rare, and, when they occur, are slight. Lethargy or sopor occurs subsequently to the delirium. Local irritation is not well marked.

These characters distinguish the effects of belladonna from those of any other substance, except henbane, stramonium, and perhaps from some other solanaceous species (see *ante*, p. 237).

When applied to the eyebrow, belladonna causes dilatation of the pupil, without necessarily affecting the other eye or disturbing vision. Segalas³ thought that absorption or imbibition was essential to this effect; but the action on the iris depends, according to Müller,⁴ not on the operation of the belladonna on the central organs of the nervous system, but on its topical, paralyzing influence on the ciliary nerves (see vol. i. p. 234). When, however, belladonna is swallowed, it is obvious that the irides can become affected through the general system only, and in this case the dilatation of the pupil is accompanied with disturbance of vision.⁵ The pneumo-gastric nerve is obviously concerned in producing the affection of the mouth, and the difficulty of deglutition and articulation.

The disorder of the intellect and of the external senses caused by belladonna proves that the influence of this agent is not limited to the excito-motory system,

¹ *Elements of Physiology*, translated by Dr. Baly, vol. ii. pp. 1144 and 1153, 1842.

² *Materia Medica*.

³ *Physiology*, vol. i. p. 630.

⁴ *Lancet*, 1826—27, vol. xii. p. 170.

⁵ For some interesting observations on the associated functions of the retina and iris, consult Grainger's *Observations on the Structure and Functions of the Spinal Cord*, p. 72, *et seq.*—The power which belladonna possesses of dilating the pupil was discovered by J. A. H. Reimarus, and was made known by Daries in 1776 (*Marx, Lond. Med. Gaz. N. S.* vol. i. p. 183, 1844—45).

but is extended to those portions of the nervous centres which are the seat of the intellect and of sensibility. I have, therefore, classed it among the phrenics (see vol. i. p. 235) and anæsthetics (see *ante*, p. 238).

USES.—Belladonna has been employed to allay pain and nervous irritation (*cr. thismus nervosus*, of some authors); to diminish the sensibility of the retina to the impression of light; to produce dilatation of the pupil; to counteract that condition of brain which is accompanied with contraction of the pupil; and to lessen rigidity and spasmodic contraction of muscular fibres. These uses obviously arise out of the ascertained physiological effects of the remedy. There are others, however, which may be regarded as altogether empirical; such as its employment to resolve or discuss scirrhus tumours.

The indications and contraindications for its use are not sufficiently established to induce us to place much confidence in them. My own experience leads me to believe that it is not a remedy fitted for plethoric constitutions, or for febrile or acute inflammatory cases; and I am not disposed to admit the observations of Dr. Graves, hereafter to be mentioned, as offering any valid objections to these statements.

1. *To allay pain and nervous irritation.*—As an anodyne in most internal pains, no remedy hitherto proposed is equal to opium; but this agent totally fails us in many of those external pains known as *neuralgia*, *prosopalgia*, or *tic douloureux*. In such cases, belladonna occasionally succeeds in abating, sometimes in completely removing pain; while it totally fails to give relief in the internal pains for which experience has found opium so efficacious. It is remarkable, therefore, that while both these cerebro-spinals (narcotics, *auctor.*) agree in lessening pain, they totally disagree as to the cases in which they succeed, and for which they are individually applicable. In the treatment of neuralgia, belladonna is employed both internally and externally. I believe that, to be successful, it requires, in many cases, to be persevered in until dryness of the throat, dilatation of pupil, and some disorder of vision are produced. Just as in many diseases for which mercury has been found a most efficient remedy, it is necessary to continue the use of this mineral until the mouth be affected, and often even to use it for some time afterwards. Of the success of belladonna in the treatment of neuralgia, we have abundant evidence in the published cases of Mr. Bailey,¹ and of several other practitioners.² My own experience of the use of this remedy leads me to regard it as very much inferior to aconite as a local remedy for this disease.

Besides neuralgia, there are many other painful affections against which belladonna is used as a local anodyne. Such are arthritic pains, painful ulcers, glandular enlargements which are tender to the touch, &c. Dr. Osborne³ says that, given internally, it causes an immediate cessation of the migratory or flying pains of rheumatism, without producing any effect on the fixed pains.

2. *As an antispasmodic.*—To relieve rigidity and spasmodic contraction of muscular fibres, belladonna sometimes proves serviceable as a topical remedy. In *rigidity of the os uteri*, during lingering labours or puerperal convulsions, the extract or an ointment of belladonna (see *unguentum belladonnæ*) has been applied to the part by way of friction. Though the practice has been lauded by Chaussier,⁴ and adopted by Velpeau,⁵ Conquest,⁶ and others, yet it has not found much favour with British practitioners. It cannot be regarded as a substitute for, but only an adjuvant to depletion; and its use is not devoid of danger; for, not to insist on the possibility of absorption, and the consequent injurious effects therefrom, it is obvious that the long-continued friction of the tender womb, and the removal of the lubricating mucus, may dispose to inflammation. In *spasmodic stricture of the urethra*, and of the sphincters of the bladder and rectum, and in *spasmodic con-*

¹ *Observ. relat. to the Use of Belladon. in painful Disord. of the Head and Face*, 1818.

² *Bayle, Bibl. Thérap.* t. ii.

³ *Consid. sur les Convuls. qui attaquent les Femmes enceintes*, 2d ed. 1824.

⁴ *Traité compl. des Accouchem.*

⁵ *London Med. Gaz.* Feb. 21, 1840.

⁶ *Outlines of Midwifery.*

traction of the uterus, the topical use of the extract (smeared on a bougie, applied to the perineum or other parts, or employed by way of a clyster) has in some cases appeared to give relief.¹ In *strangulated hernia*, it has been employed to produce relaxation of the abdominal muscles.²

In a case of *angina pectoris*, unconnected with organic disease, the application of a belladonna plaster to the chest (before the ulcerations caused by tartar emetic ointment had healed) produced alarming signs of poisoning; but when these had subsided, all symptoms of the angina had totally disappeared.³

Considerable relief has been gained in several cases of *hooping-cough* by the use of belladonna.⁴ Its occasional efficacy depends in part, probably, on its lessening the necessity of respiration,⁵ as well also on its power of obviating spasm of the bronchial tubes, and of decreasing the susceptibility of the bronchial membrane to the influence of the exciting causes of the paroxysms. But, like all other vaunted specifics for this peculiar disease, it frequently fails to give the least relief.

3. In *maladies of the eyes*.—Belladonna is applied to the eye for two purposes: the first, and the most common, is to dilate the pupil; the other is to diminish the preternatural sensibility of the retina to the impression of light. *Dilatation of the pupil* is sometimes produced, in certain diseases of the eye, in order to enable us to examine the condition of the refractive humours, and thereby to ascertain the nature and extent of the malady; as in cases of incipient cataract, which might otherwise be occasionally confounded with glaucoma or amaurosis. In the operation of cataract by solution or absorption (*keratonyxis*), the full dilatation of the pupil by belladonna is essential.⁶ In *iritis*, dilatation of the pupil is important, in order to prevent, or in recent cases to rupture, adhesions of the uvea to the capsule of the crystalline lens. Some surgeons consider it an objectionable remedy during the early stage of the disease. In *prolapsus iridis*, benefit is, under some circumstances, gained by the use of belladonna; as, where there is opacity of the cornea covering the pupil, the dilatation of the aperture, so as to get its circumference beyond the opaque spot, is attended with an improvement of vision. These are some of the cases in which dilatation of the pupil by belladonna is advisable. It is usually effected by applying the extract (see *extractum belladonnæ*) to the parts around the eye, or to the conjunctiva. The dilatation usually takes place within a few minutes, and sometimes continues for twenty-four hours.

Belladonna is sometimes employed in inflammatory and other affections of the eye, to diminish the morbid sensibility of this organ to the influence of light.⁷

4. As a *resolvent* or *discutient*.—In enlargement and induration of the lymphatic glands, in scirrhus and cancer (or diseases which have been supposed to be such), belladonna has gained no slight repute from its supposed resolvent or discutient properties. That it may give relief by its anodyne powers we can easily understand, but that it has any real resolvent or discutient properties in the diseases just enumerated, may be reasonably doubted, notwithstanding the favourable reports of Gataker,⁸ Cullen,⁹ Blackett,¹⁰ and others.¹¹ Bromfield¹² and others have reported unfavourably of it, and no one, I think, now places any reliance on it.

5. As a *prophylactic* against *scarlatina*.—The introduction of belladonna into practice as a preventive of scarlet fever, is owing to the absurd homœopathic axiom of "*similia similibus curantur*;" for, as this plant gives rise to an affection of the throat, and sometimes to a scarlet rash on the skin, its power of guarding the sys-

¹ *Brit. and For. Med. Rev.* vol. ii. p. 261.

² Van Lenth, Kohler, and Pages, quoted by Bayle, *Bibl. Thérap.* t. ii. and *Brit. and For. Med. Rev.* vol. ii. pp. 262—3.

³ Davies, *Lect. on Diseases of the Lungs and Heart*, p. 496.

⁴ See the observations of Schaeffer and Wetzler, of Meglin, and of Raisin, quoted by Bayle. *Bibl. Thérap.* t. ii.

⁵ Laennec, *Treat. on Dis. of the Chest*, by Forbes, pp. 77 and 99.

⁶ Lawrence, *Lect. in Lancet*, for Sept. 9, 1826.

⁷ Lawrence, *Rep. Med.* t. i. p. 17, 1826; and t. ii. p. 384.

⁸ *Observations on the Internal Use of Solanum*, 1757.

⁹ *Med. Med.*

¹⁰ See Bayle, *Bibl. Thérap.* t. ii.

¹¹ *Essay on the Use of Atropa Belladonna*, 1826.

¹² *Account of the English Nightshades*, 1757.

tem against the reception of scarlet fever has been assumed; and the assumption has been endeavoured to be established by an appeal to experience. Bayle¹ has collected from various publications 2,027 cases of persons who took this medicine, and were exposed to the contagion; of these 1,948 escaped. Oppenheim² gave it to 1,200 soldiers, and only twelve became affected. To the authorities here referred to may be added Hufeland³ and Koreff,⁴ who admit, from their own personal observations, the efficacy of the remedy, though they have not specified the number of cases in which they have tried it. But bearing in mind the well-known capriciousness evinced by scarlet fever (as indeed by other contagious disorders) in regard to the subjects of its attacks, and the large number of those who, though exposed to its influence, escape, the best evidence hitherto adduced in favour of the notion must be admitted to be inconclusive. While, therefore, the facts brought forward in favour of the existence of this prophylactic power are only negative, those which can be adduced against it are positive. For I conceive twenty cases of failure are more conclusive against the opinion here referred to, than one thousand of non-occurrence are in favour of it. Now Lehman,⁵ Barth,⁶ Wendt,⁷ Muhrbeck,⁸ Hoffmann,⁹ Bock,¹⁰ and many others that I could refer to, declare it has failed in their hands to evince its prophylactic powers. In this country we have no extended series of observations to quote; but the cases which I am acquainted with are decidedly against the efficacy of the remedy. A remarkable failure is mentioned by Dr. Sigmond,¹¹ of a family of eleven persons who took the supposed specific, yet every individual contracted the disease.

6. *In fever, with contraction of the pupil.*—Dr. Graves¹² has recently proposed the use of belladonna in those cases of fever with cerebral disease which are attended with contraction of the pupil. "It is not unreasonable," he observes, "to suppose that the state of the brain which accompanies dilatation of the pupil is different from that which accompanies contraction; and if belladonna has an effect in producing that cerebral state which is attended with dilatation, it is not going too far to infer, that its administration may do much towards counteracting the opposite condition; neither is it unphysiological to conclude, that if a remedy be capable of counteracting, or preventing, one very remarkable effect of a certain morbid state of the brain, it may also counteract other symptoms connected with the same condition." This line of argument, it must be admitted, is ingenious and plausible, and is supported by reference to several apparently successful cases treated on the principles here laid down. But I would observe, if the above reasoning were valid, opium should be serviceable in cerebral diseases attended with dilatation of pupil, since it causes contraction of this aperture. Now this is in direct opposition to our every-day experience of the uses of this important narcotic.

7. *In other diseases.*—Cruveilhier¹³ has found belladonna-smoking relieve some cases of *phthisis*. The fresh leaves were infused in a strong solution of opium, and then dried like tobacco; the patients began by smoking two pipes a day, and the quantity was gradually increased to six pipes. Perhaps this practice would be beneficial in spasmodic asthma and old catarrhs. In *hydrophobia*, notwithstanding the asserted prophylactic powers of this medicine,¹⁴ there is no valid ground for believing in its efficacy. I tried it in one case without success. In *epilepsy*, *mania*, *hysteria*, *chorea*, and some other maladies of the centro-spinal system, occasional benefit has resulted by the use of belladonna. In *ileus*,¹⁵ it has been most successfully used in the form of clyster, as a substitute for tobacco, which is objectionable on account of the horrible sickness and great depression which it causes.

¹ *Bibl. Thérap.* t. ii. p. 504.

² *Lancet*, May 2, 1829.

³ Bayle, *Bibl. Thérap.* t. ii. p. 417.

⁴ Rust and Casper's *Krit. Repert.* Bd. xxii. S. 27.

⁵ *Ibid.* Bd. xxv. S. 115.

⁶ *Lancet*, vol. ii. p. 78, 1836—7.

⁷ *Lancet*, vol. i. p. 520, 1828—9.

⁸ See the authorities quoted by Bayle, *Bibl. Thérap.* t. ii.; and Richter, *Ausf. Arzneim.* Bd. ii.

⁹ *Brit. and For. Med. Rev.* vol. iv. p. 223.

¹⁰ *Lond. Med. Gaz.* vol. xiii. p. 814.

¹¹ *Lond. Med. Gaz.* vol. iv. p. 297.

¹² *Ibid.*

¹³ Rust's *Magaz.* Bd. xxiv. S. 495.

¹⁴ *Ibid.* S. 80.

¹⁵ *Dubl. Journ. of Med. Science*, July 1, 1832.

ADMINISTRATION.—The dose of the *powder* for an adult is one grain, which should be gradually increased until dryness of the throat, dilatation of pupil, or some head symptoms, are produced. For children, the dose at the commencement should be one-eighth of a grain. For internal as well as external use the *extract* or *tincture* is, however, commonly employed. For external use an *infusion* of the leaves is sometimes used as a fomentation, or is made into a poultice with bread or linseed meal.

ANTIDOTES.—Similar to those for opium. After the use of evacuants the vegetable acids have appeared to give great relief. Decoction of nutgalls or green tea might probably prove serviceable.

I. EXTRACTUM BELLADONNÆ, L. E. [U. S.]; *Succus spissatus Belladonnæ, D.; Extract of Belladonna.*—(Fresh Belladonna Leaves 1℔j. Bruise them in a stone mortar; then press out the juice, and evaporate it, unstrained, to a proper consistence, *L.*—The *Edinburgh College* directs the expressed juice to be filtered, and then to be evaporated, in the vapour-bath, to the consistence of firm extract, stirring constantly towards the close.—The *Dublin College* takes of fresh Belladonna Leaves, collected when the plant begins to flower, any convenient quantity. Crush them in a mortar, express the juice, and allow it to stand for twenty-four hours. Pour off the clear liquor, and set it aside for subsequent use; and, having placed the sediment in a calico filter, wash it with an equal bulk of distilled water, and mix the washings with the decanted liquor. When, by the application of a water heat, coagulation has occurred, skim off the coagulated matter, filter the hot liquid through flannel, mix in now the washed sediment, and evaporate to the consistence of a firm extract, by a steam or water bath, constantly stirring, particularly towards the close of the evaporation.)—1 cwt. of fresh belladonna yields from 4 to 6 lbs. of extract.¹ Dose, gr. j to gr. v, cautiously increased. As the strength of the extract is extremely variable, some writers recommend only one-quarter or one-half of a grain to be given at the commencement of its use, and to be repeated three times a day; and the dose to be increased until the well-known effects of the remedy are produced. Mr. Bailey observes that he at first began with one grain, and repeated it every four hours until relief followed; but further experience induced him to commence with three times that quantity, and, if a repetition were necessary, to give it in diminished doses afterwards. Spread upon leather, the extract is frequently used as a plaster to relieve neuralgic and other pains (see *Emplastrum Belladonnæ*). Diluted with water to the consistence of cream, it is applied to the eyebrow to produce dilatation of the pupil; or an aqueous solution of the extract is dropped between the lids. Mixed with lard or spermaceti ointment, it is used as a topical anodyne and antispasmodic in various diseases (see *Unguentum Belladonnæ*). A bougie smeared over with the extract and oil is sometimes used with benefit in stricture.² A drachm or two of the extract, either alone or in the form of ointment, may be applied to the os uteri to diminish rigidity. In irritation of the bladder, urinary organs, or rectum, clysters holding in solution the extract are sometimes used. Rubbed into the perineum or over the track of the urethra, the extract or ointment is useful in preventing chordee, and alleviating spasm of the neck of the bladder.

[As the fresh leaves of Belladonna are with difficulty procured in the United States, as a substitute for the above extract, the Pharmacopœia directs an extract to be made from the dried leaves by means of diluted alcohol. The formula is, Belladonna, in coarse powder, 1℔j; Diluted Alcohol Oiv. Moisten first with half a pint of the fluid, and allow to stand for 24 hours. Then transfer to a percolator and displace, driving over the last quantity of fluid with water. Evaporate the solution to the proper consistence. This constitutes the *Extractum Belladonnæ Alcoholicum*, U. S. See a similarly prepared extract from Hyoscyamus.]

¹ Brande, *Man. of Pharm.* 3d edit. p. 401.

² *Lond. Med. Gaz.* vol. v. p. 735.

2. **EMPLASTRUM BELLADONNÆ**, L. E. D. [U. S.]; *Plaster of Belladonna*.—(Extract of Belladonna $\mathfrak{z}\mathfrak{j}$, *D.*), Soap Plaster, of each, $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$ [Resin Plaster $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$, *D.*, $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$, *E.*]. Add the extract to the plaster, melted by the heat of a water-bath, and mix.)—[The U. S. P. directs of Resin Plaster $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$; Extract of Belladonna $\mathfrak{z}\mathfrak{i}\mathfrak{s}\mathfrak{s}$.]—Anodyne and antispasmodic. Applied for the relief of neuralgic, rheumatic, and other pains. It is said to relieve the pain of dysmenorrhœa when applied to the sacrum. In spreading it, care must be taken not to employ a very hot spatula, or the properties of the extract will be injured.

3. **UNGUENTUM BELLADONNÆ**, L. [U. S.]; *Ointment of Belladonna*.—(Extract of Belladonna $\mathfrak{z}\mathfrak{j}$; Spermaceti Lard $\mathfrak{z}\mathfrak{j}$; [Lard $\mathfrak{z}\mathfrak{j}$ U. S.] Mix.)—A very useful preparation; and may be used as an anodyne and antispasmodic in some of the before-mentioned cases.

4. **TINCTURA BELLADONNÆ**, L. [U. S.]; *Tinctura Foliorum Belladonnæ*, D.; *Tincture of Belladonna*.—(Belladonna Leaves, dried, $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Proof Spirit [Diluted Alcohol, U. S.] Oij. Macerate for seven [fourteen, *D.*] days, and strain.)—Dose, $\mathfrak{m}\mathfrak{x}\mathfrak{x}$ to $\mathfrak{m}\mathfrak{x}\mathfrak{l}$. Mr. Blackett¹ prepared a saturated tincture of belladonna by macerating, for fourteen days, $\mathfrak{z}\mathfrak{x}$ of extract of belladonna in lbj of proof spirit; then straining. The dose of this is $\mathfrak{m}\mathfrak{i}\mathfrak{j}$ or $\mathfrak{m}\mathfrak{i}\mathfrak{i}\mathfrak{j}$, gradually increased; in the form of lotion, a drachm of it was added to eight ounces of liquid.

SUCCUS BELLADONNÆ.—The Preserved Juice of Belladonna may be substituted for the tincture. From 2 cwt. of belladonna leaves, gathered towards the end of June, 36 imperial quarts of juice have been procured.

5. **ATROPIA**, L.; *Atropina*; *Atropium*; *Atropine*. Symbol At . Formula $\text{C}^{24}\text{H}^{23}\text{NO}^6$. Eq. Wt. 289.—Found in all parts of the plant. Discovered in 1819 by M. Brandes. The most improved processes for the preparation of this alkaloid are those of Mein² and Richter.³ The following is a sketch of Mein's process as modified by Liebig:—

Fresh dried and powdered belladonna root is to be exhausted by alcohol, sp. gr. 0.822. To the tincture add slaked lime (in the proportion of one part of lime to 24 parts of dried root). Digest for 24 hours, frequently shaking. Add, drop by drop, sulphuric acid to the filtered liquor till there is a slight excess; then filter again, and distil off rather more than half of the spirit. To the residue add some water, and evaporate the remainder of the alcohol as rapidly as possible, but *by a very gentle heat*; filter again, and continue the evaporation until the liquid is reduced to the 1-12th part of the weight of the root employed. To the cold liquid add, drop by drop, a concentrated solution of carbonate of potash, to throw down a dark grayish-brown precipitate, taking care not to render the liquid alkaline. In a few hours filter again; add carbonate of potash as long as a precipitate (atropia) is produced; and in from 12 to 24 hours collect the crystallized atropia on a filter, press it between folds of blotting-paper, and dry it.

To purify the dry but impure atropia, make it into a paste with water, and again squeeze between folds of blotting-paper; dry it, and dissolve in five times its weight of alcohol. The filtered liquor is to be decolorized by shaking it with purified animal charcoal, then deprived of the greater part of its alcohol by distillation, and afterwards evaporated by a gentle heat, so as to allow the atropia to crystallize; or draw off half of the spirit, add, gradually, water (3 or 4 parts), which renders the liquid milky, heat to boiling, and allow it to cool slowly; or add to the spirituous solution 6 or 8 times its volume of cold water, which renders the liquid milky, and in from 12 to 24 hours the atropia crystallizes, and is to be dried on blotting-paper.

In this process, the alcohol extracts from the belladonna root a salt of atropia; this is decomposed by the lime, which removes the organic acid and colouring extractive matter. Sulphuric acid is then added, to unite with the disengaged atropia;

¹ *Lond. Med. Rep.* vol. xix. p. 458.

² *Journ. de Pharm.* t. xx. p. 27, 1-34; also Thomson's *Chemistry of Organic Bodies*, p. 273, 1827.

³ *Pharm. Central-Blatt für 1837*, p. 613.

for this alkaloid, when free, and especially when in contact with alkalies, readily undergoes decomposition by heat. The solution of sulphate of atropia must be evaporated by a very gentle heat, because the atropia salts, especially in the impure state, easily undergo decomposition. A small quantity of carbonate of potash is necessary, to separate a resinous substance which impedes the crystallization of the atropia. An excess of a concentrated solution of carbonate of potash is required to precipitate, as speedily as possible, the atropia, as by long contact with watery fluids this alkaloid disappears.

Messrs. Bouchardat and Cooper¹ recommend the following mode of preparing atropia: The atropia is to be precipitated by a watery solution of iodine in iodide of potassium, and the ioduretted hydriodate of atropia decomposed by zinc and water. The metallic oxide is separated by means of carbonate of potash, and the alkaloid dissolved in alcohol.

Atropia crystallizes from its concentrated hot, watery, or spirituous solution in white, transparent, silky prisms; from its solution in dilute spirit, in needles like those of sulphate of quinia. It is odourless, and has a very bitter, acrid, somewhat metallic taste. Impure atropia is not crystalline, is more or less coloured, and has an unpleasant odour. One part of atropia requires 200 parts of cold water, or 54 parts of hot water, to dissolve it. It is soluble in $1\frac{1}{2}$ times its weight of cold alcohol, but requires, at ordinary temperatures, 25 parts of ether to dissolve it, or 6 parts of boiling ether.

It reacts on vegetable colours as an alkali, fuses by heat, and at a higher temperature is partly volatilized and partly decomposed. Nitric acid dissolves it, forming a yellow solution. Cold oil of vitriol dissolves it without colour; but if heat be applied, the mixture acquires a red colour. When heated with a solution of potash or soda, atropia undergoes decomposition, and gives out ammonia.

White, has the shape of prisms, is soluble in water and in spirit. No characters are at present known by which its purity can be certainly indicated, L.

Atropia possesses the property of left-handed circular polarization; but its rotating power is feeble, though it is unaffected by the presence of acids.

A watery solution of a salt of atropia is reddened by tincture of iodine; yields a citron-yellow precipitate with a chloride of gold; a whitish, flocculent precipitate with tincture of nutgalls; and a yellowish-white with chloride of platinum. The *sulphate*, *hydrochlorate*, and *acetate of atropia* are crystalline salts.

Atropia is a most energetic poison. Its effects are similar to, but more powerful than those of belladonna. Dogs are readily poisoned by it; but rabbits are less under its influence. A very minute (imponderable) quantity applied to the eye is sufficient to dilate the pupil. Given to dogs it excites vomiting, dilatation of the pupil, and stupor. On man, the effect is much stronger. One centigramme (about $\frac{1}{60}$ th of a grain) produces the following symptoms: At first, acceleration of the pulse by eight to twenty strokes; after from fifteen to thirty minutes, an affection of the brain is produced. The first and most constant symptom is dry throat, with difficulty of swallowing. The second is dilatation of pupils, with dimness of sight, also giddiness, noise in the ears, hallucination, delirium, and occasionally strangury; numbness of the limbs, a sensation of formication in the arms, rigidity of the thighs, depression of the pulse. The voice is sometimes weakened; or there may be complete aphonia. The unfavourable symptoms disappear after from twelve to twenty hours.

Atropia has recently been employed medicinally (chiefly as an external agent) as a substitute for belladonna, to which it is considered superior, on account chiefly of the uncertainty of the latter. It is of course much more energetic, and, for external use especially, is much cleaner than the extract. As a topical agent, it has been employed as a mydriatic (see vol. i. p. 245) or dilator of the pupil, by Reisinger, Mr. W. W. Cooper,² and Dr. Brookes,³ in cataract, &c. The last-mentioned writer states that, in a case of glaucoma, he succeeded in causing dilatation of the pupil

¹ *Annales de Thérapeutique pour 1849.*

² *Ibid.* January 30, 1847.

³ *Lancet*, June 8, 1844.

with an ointment of atropia when belladonna failed. As an anæsthetic or anodyne (see vol. i. p. 238), he used the same preparation with success in a painful affection of the face (neuralgia?).—The local pain which atropia produces when used endermically (see vol. i. p. 174) is of very short duration, and is unattended with any ill consequences. Internally, atropia has been employed in whooping-cough, chorea, and some other nervous diseases.

The dose of atropia for internal use is from about 1-30th to 1-6th of a grain. Its employment requires great caution. The safest mode of administration is in solution, on account of the facility with which the dose may be adjusted; but it has also been given, mixed with sugar, in the form of powder; and, mixed with the powder of marshmallow root and honey, in the form of pills. It may be employed endermically (see vol. i. p. 174) in doses of about the $\frac{1}{30}$ th of a grain gradually increased to $\frac{1}{10}$ th of a grain. For a collyrium, to dilate the pupil, one grain may be dissolved in 400 grs. of water; and a few drops of the solution applied to the eye.

1. *Tinctura Atropiæ*; Tincture of Atropine.—Dissolve one grain of atropia in one fluidrachm of rectified spirit, and then add seven fluidrachms of distilled water. Dose, from fifteen minims gradually and cautiously increased to eighty minims. One drop of this solution, applied to the eye night and morning, was used by Mr. W. W. Cooper to keep up dilatation of the pupil.

2. *Solutio Atropiæ Hydrochloratis*; Solution of Muriate of Atropine.—Dissolve one grain of atropia in a fluidrachm of water acidulated with one minim of hydrochloric acid; then add seven fluidrachms of water. Dose, from fifteen to eighty minims.

3. *Unguentum Atropiæ*; Ointment of Atropine.—Atropia, five grains; lard, three drachms; attar of roses one drop. Mix.—The size of a pea, to be applied three times a day. Used by Dr. Brookes, with great success, in a painful affection of the face, and to dilate the pupil.

6. **ATROPIÆ SULPHAS**, L.; *Sulphate of Atropia*.—(Dilute Sulphuric Acid fʒij; Atropia Ὀνίγς, or as much as may be sufficient; Distilled Water fʒss. Add gradually to saturation the atropia to the acid mixed with the water. Let the liquor be strained, and evaporate it by a gentle heat that crystals may be formed, L.)—The College observes that this salt is intended for external use only. It is employed in the form of solution, prepared by dissolving one or two grains in a fluidounce of water, to produce dilatation of the pupil.

173. DATURA STRAMONIUM.—COMMON THORN-APPLE.

Sex. Syst. Pentandria, Monogynia.

(Folium et Semen, L. [U.S.]—Herb, E.—The seed, D.)

HISTORY.—This plant, being a native of Greece, must have been known to the ancient Greek botanists; though it is impossible now to identify it, with certainty, with any of the plants described by them. It appears, however, to agree tolerably well with the σπράχνος μανίκός of Theophrastus.¹ *Datura Stramonium* is mentioned by Fuchsius in 1542.

BOTANY. *Gen. Char.*—*Calyx* tubular, frequently angular, 5-cleft at the apex, or longitudinally slit, falling off by a circular horizontal incision above the peltate base. *Corolla* hypogynous, funnel-shaped, with a large, spreading, plaited 5-10-toothed limb. *Stamens* 5, inserted into the tube of the corolla, inclosed or somewhat exserted; anthers dehiscing longitudinally. *Ovary* incompletely 4-celled, the alternate dissepiment being lost above the middle, the other one complete; the middle on both sides placentiferous. *Style* simple; *stigma* bilamellate. *Capsule* ovate or sub-globose, mucicate or aculeate, rarely smooth, half 4-celled, incompletely 4-valved at the septa. *Seeds* numerous, reniform. *Embryo* within fleshy albumen, subperipheral, arched (Endlicher).

¹ *Hist. Plant. lib. ix. cap. 12.*

Sp. Char.—Annual. Leaves ovate, angulate-dentate, wedge-shaped at the base, rather smooth. Fruit ovate, erect, densely spinous. Calyx equal to the diameter of the limb of the corolla (Nees).

A bushy, smooth, fetid herb. Stem much branched, forked, spreading, leafy. Leaves from the forks of the stem, large, unequal at the base, variously and acutely sinuated and toothed, simple ribbed, veiny, of a dull green. Flowers axillary, erect, white, sweet-scented, especially at night, about 3 inches long. Fruit as big as a walnut, in its outer coat very prickly. Seeds black (Smith).

Hab.—Indigenous; in waste ground and on dunghills. Annual. Flowers in July.

Several other species of *Datura* are used in the East.

Datura ferox, Linn.—Annual. Leaves ovate, angulate-dentate, cuneiform at the base, glaucous. Fruit ovate, erect, pyramidal spinous. Calyx longer than the diameter of the limb of the corolla (Nees).—Nepal. In 1802, General Gent introduced this species into this country as a remedy for asthma. It was employed by smoking it.¹ Waitz² says that half an upright capsule acted violently on a girl.

Datura fastuosa, Mill.—Annual. Leaves ovate, acuminate, repandly-toothed, unequal at the base, and are, as well as the stem, somewhat downy. Fruit nodding, tuberculated (Nees).—East Indies. In 1811, Dr. Christie³ directed attention to this species. Mr. Skipton⁴ administered the decoction of the root of this plant; and Dr. Adams⁵ used a tincture (prepared as tincture of digitalis, *Ph. L.*).

Datura tatula, Linn.—Annual. Leaves cordate-ovate, angulate dentate, unequal at the base, smooth. Fruit ovate, erect, spinous (Nees).—Schubarth⁶ gave half a pound of the bruised leaves of this species to a horse without effect; twenty-one ounces of the half-ripe fruit caused dejection, increased secretion, and loss of appetite. Cigars for the use of asthmatics are made of this species.

Datura alba, Rumph.; *D. Metel*, Roxb.—Annual. Leaves ovate, acuminate, repandly-dentate, unequal at the base, rather smooth. Fruit nodding, spinous.—East Indies. Both this and the preceding species have been employed, especially in the East, to cause intoxication for criminal and licentious purposes.⁷

DESCRIPTION.—The herb (*herba stramonii*) should be collected when the plant is in flower. The leaves (*folia stramonii*) are then to be carefully dried. In the fresh state their odour, when bruised, is unpleasant and narcotic; their taste nauseous and bitter. By drying, the odour is lost, but the bitter taste remains. The seeds (*semina stramonii*) are small, compressed, kidney-shaped, roughish, dark-brown or blackish, dull, and odourless; they have a bitter, nauseous, somewhat acrid taste.

COMPOSITION.—The herb was analyzed, in 1815, by Promnitz,⁸ the seeds in 1820, by Brandes.⁹

Promnitz's Analysis.

Resin	0.12
Extractive containing the daturia]	0.60
Gummy extractive	0.58
Green fecula	0.61
Albumen	0.15
Phosphatic and vegetable salts of lime and magnesia	0.23
Water	91.25
Woody fibre	5.15
Loss	1.28

Brandes's Analysis.

Malate of daturia with some uncrystallizable sugar	1.80
Fixed oil with some chlorophylle	16.05
Wax	1.40
Resin insoluble in ether	9.90
Extractive	0.60
Gummy extractive	6.00
Gum and bassorin with some salts	11.30
Albumen and phytocolla	6.45
Glutenin	5.50
Malates of daturia, potash, and lime, and acetate of potash	0.60
Woody fibre	23.35
Water	15.10
Loss	1.95

Fresh herb of stramonium 100.00

Seeds of stramonium 100.00

1. *Datura* (*Daturina*, or *Daturium*)—Formula, $C^{34}H^{23}NO^6$. A vegetable alkali said to exist in stramonium. The properties assigned to it by Geiger and Hesse¹⁰ are the following: It crys-

¹ *Ed. Med. and Surg. Journ.* vol. viii. p. 65.

² *Ed. Med. and Surg. Journ.* vol. vii. p. 158.

³ *Ibid.* p. 370.

⁴ *Lond. Med. and Phys. Journ.* vol. xxv. pp. 589–1.

⁵ *Gmelin's Handb. d. Chem.* Bd. ii. S. 1305.

⁶ *Pharm. Central-Blatt für 1835*, p. 85.

⁷ *Wibmer, Wirk. d. Arzn. u. Gifte*, Bd. ii. S. 286.

⁸ *Trans. Med. and Phys. Soc. Calcutta*, vol. i. p. 121.

⁹ *Wibmer, op. cit.* p. 300.

¹⁰ *Ibid.* and vol. xxvi. p. 22.

¹¹ *Ibid.*

tallizes in colourless, odourless, brilliant prisms, which have at first a bitterish, then a tobacco-like flavour. It requires 280 parts of cold, or 72 parts of boiling water to dissolve it; it is very soluble in alcohol, less so in ether. In most of its properties it agrees with hyoscyamia. It strongly dilates the pupil, and has a poisonous action on animals. Dr. Avon Planta¹ has recently submitted *atropia* and *daturia* to comparative examination, and declares that they are identical in composition and chemical properties.

2. **EMPYREUMATIC OIL OF STRAMONIUM** (*Pyrodaturia*?).—Resembles tar and the aqueous fluid which distils along with its acid. This arises from the woody part of the plant having been employed. The oil itself does not differ, in its physical and chemical properties, from the empyreumatic oil of foxglove before (see *ante*, p. 457) described.²

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—A branch of stramonium was killed by immersing it in a watery solution of the extract of its own species.³

β. On Animals generally.—Its influence on herbivorous animals is much less than that on man. Five ounces of the expressed juice given to the horse, cause merely slight drowsiness and gaping.⁴ Two pounds and a half of the seeds killed a horse in fifty-two hours.⁵ From Orfila's experiments with it on dogs,⁶ it does not appear to act powerfully as a local irritant. Its effects were very similar to those caused by belladonna.

γ. On Man.—The symptoms produced on man closely resemble those of belladonna. In small but gradually increased doses, it diminishes sensibility, and thereby frequently alleviates pain. It does not usually affect the pulse; it slightly and temporarily affects the pupil, and has no tendency to cause constipation, but rather relaxation. Though it allays pain, it does not usually produce sleep. In larger doses, it causes thirst, dryness of the throat, nausea, giddiness, nervous agitation, dilatation of the pupil, obscurity of vision, headache, disturbance of the cerebral functions, perspiration, occasional relaxation of bowels, and in some cases diuresis. It has no direct tendency to induce sleep, and hence it cannot be called *soporific*. But indirectly, by alleviating pain, and thereby producing serenity and ease, it often disposes to sleep. In fatal doses, the leading symptoms are flushed countenance, delirium (usually maniacal), dilatation of the pupil, dryness of the throat, loss of voice, difficulty of deglutition, convulsions, and, in some cases, palsy. A very interesting fatal case of poisoning by 100 seeds is related by Mr. Duffin.⁷ The patient (his own child) was two years and a quarter old. In addition to the preceding symptoms, there were a hot, perspiring skin, flushed, slightly swollen face, pulse almost imperceptible, but, as far as could be felt, it was natural in regard to frequency, and coldness of the inferior extremities. The anterior fontanelle was neither tense, hot, nor in the slightest degree raised by the cerebral pulsations; so that there did not seem to be any active determination of blood to the brain. During the continuance of the coma the pulse became extremely rapid. Death occurred twenty-four hours after swallowing the seeds.

Vogt⁸ says stramonium is probably distinguished from belladonna by the following peculiarities:—

1. Its effects are more similar to those of acrid vegetables, especially of *Helleborus*.
2. It operates more strongly, but more in the manner of the acrid substances, on the nervous system, especially on the central organs, viz., the ganglia, spinal cord, and brain.
3. Its secondary effects on the irritable system are not so marked; for most observers have failed to detect any alteration of pulse, and a slow pulse is more frequently mentioned than a quick one.
4. It operates on the organic life more strongly. It more strongly and directly promotes the secretions, especially the secretion of the skin.
5. Marcet⁹ and Begbie¹⁰ have inferred, from numerous observations, that it possesses an antidote property, which it frequently evinces where opium and belladonna fail.

USES.—A more extended experience of this plant is requisite to enable us to speak with much confidence of its employment. The similarity of its effects with

¹ *Pharmaceutical Journal*, vol. x. p. 561.

² *Morries, Ed. Med. and Surg. Journ.* vol. xxxiv. p. 374.

³ Macaire, quoted by De Candolle, *Phys. Vég.* p. 1354.

⁴ *Morroud, Pharmac. Vét.* p. 350.

⁵ Viborg, in *Wibmer's Wirk. d. Arzneim.* u. Gifte, Bd. ii. S. 292.

⁶ *Toxicol. Gen.*

⁷ *Lond. Med. Gaz.* vol. xv. p. 194.

⁸ *Pharmakodyn.* Bd. i. S. 164.

⁹ *Med.-Chir. Trans.* vols. vii. and viii.

¹⁰ *Trans. of the Med. Soc. Edinb.* vol. i.

those of belladonna would lead us to expect a similarity of uses. Like the last-mentioned plant, it has been successfully employed to diminish sensibility, and thereby to relieve external pain. Some of the other uses made of it require a more impartial examination ere we can form any just estimate of their value. The indications and contraindications for its employment are probably similar to those of belladonna. In persons disposed to apoplexy it is a very dangerous remedy.

In *neurragia* (*tic douloureux*, *sciatica*, &c.), it has been employed with considerable success by Lentin,¹ Marcet,² and Begbie.³ It was given internally in the form of extract. Its external application has scarcely been tried. In *rheumatism*, it has frequently proved serviceable from its anodyne qualities.⁴ In *enterodynia* (that is, spasmodic pain of the bowels unconnected with inflammatory action or the presence of irritating substances), Dr. Elliotson⁵ found it most successful.

In some cases of *spasmodic asthma*, smoking the herb has given at least temporary relief;⁶ but the practice requires very great caution, as it has proved highly injurious, and in some instances fatal. Dr. Bree⁷ tried it in 82 asthmatic cases; in 58 of these it had no permanent effect, and in the remaining 24 it acted injuriously. General Gent, who was instrumental in introducing the practice, fell a victim to it.⁸ Aggravation of the dyspnoea, paralytic tremblings, epilepsy, headache, and apoplexy, are some of the evils said to have been induced in the cases above referred to. In persons disposed to head affections, and in aged persons, it is, therefore, a highly dangerous practice.

The diseases in which stramonium has been principally used are *mania* and *epilepsy*. Bayle⁹ has collected from the works of Storek, Schemalz, Razous, Reef, Meyer, Odhelius, Duronde, Maret, Bergius, Greding, Schneider, Bernard, and Amelung, fifty-five cases of the first, and forty-five of the latter malady, treated by stramonium; in both diseases, a considerable majority of cases are said to have been either cured or relieved by it. Without denying the occasional benefit of stramonium in these diseases, I believe the cases in which it is serviceable to be very rare, while those in which it is calculated to be injurious are very common. Dr. Cullen¹⁰ observes, that he has no doubt that narcotics may be a remedy for certain cases of mania and epilepsy; but he very justly adds, "I have not, and I doubt if any other person has learned to distinguish the cases to which such remedies are properly adapted."

Stramonium has been used to *dilate the pupil* and to *diminish the sensibility of the retina to the influence of light*; but for both of these purposes belladonna is preferred by British oculists. Wendt¹¹ used it to *lessen venereal excitement*, as in nymphomania. An ointment (made with $\frac{3}{j}$ of the powdered leaves, and $\frac{3}{iv}$ of lard) has been used as an anodyne application to *irritable ulcers* and to *painful hemorrhoids*. The application of the leaves to *burns* has been attended with dangerous results.¹²

ADMINISTRATION.—The dose of the powdered *leaves* is one grain; of the *seeds* half a grain. These doses are to be repeated twice or thrice a day, and to be gradually increased until some obvious effect is produced.

1. EXTRACTUM STRAMONII, L. E.; *Extract of Thornapple* [*Extractum Stramonii Seminis*, U. S.].—(Thornapple Seeds $\frac{3}{xv}$; Boiling Distilled Water Cong. j. Macerate for four hours in a vessel slightly covered, near the fire; afterwards take out the seeds, and bruise them in a stone mortar; return them, when bruised, to the liquor. Then boil down to four pints, and strain the liquor while hot. Lastly, evaporate to a proper consistence, *L.* The directions of the *Edinburgh College* are as follows:

¹ Bayle, *Bibl. Théor.* t. ii.

² *Med.-Chir. Trans.* vols. vii. and viii.

³ *Trans. Med.-Chir. Soc. of Edinb.* vol. i.

⁴ See the reports of Kirekhoff, Engelhart, Van-Nuffal, and Amelung, in Bayle, *op. cit.*; also Eberle, *Mat. Med.*

⁵ *Lancet*, 1826—7, vol. xii.; and 1837—8, vol. ii.

⁶ English, in *Edinb. Med. and Surg. Journ.* vol. vii.; and Dr. Sims, *Ibid.* vol. viii.

⁷ *Lond. Med. and Phys. Journ.* vol. xxvi. p. 51.

⁸ *Educ. Thérap.* t. ii.

⁹ *Ibid.* vol. xxvi. p. 49.

¹¹ *Rust's Magaz.* Bd. xxiv. S. 302.

¹⁰ *Mat. Med.*

¹² *Journ. de Chim. Méd.*

Take of the seeds of stramonium, any convenient quantity; grind them well in a coffee-mill. Rub the powder into a thick mass with proof spirit; put the pulp into a percolator, and transmit proof spirit till it passes colourless; distil off the spirit, and evaporate what remains in the vapour-bath to a proper consistence.)—(Of the above modes of preparation, that of the Edinburgh College is doubtless the best, as yielding a more efficient preparation. [The *U. S. Pharm.* directs Stramonium Seed, in powder, ℥j; Diluted Alcohol q. s. Displace with the alcohol, and evaporate to the proper consistence.] The product, according to the London and Dublin process, is about 12 per cent.¹ Recluz² states, that 16 oz. of the seeds yield 2 oz. 2 dr. by maceration in dilute alcohol; this is about 14 per cent. The dose of extract of stramonium, at the commencement, is about a quarter of a grain, which should be gradually increased until some obvious effect is produced.

[2. *EXTRACTUM STRAMONII FOLIORUM*, U. S.; *Extract of Stramonium Leaves*.—(Take of Stramonium Leaves a pound. Bruise them in a stone mortar, sprinkling on them a little water; then express the juice, and, having heated it to the boiling point, strain and evaporate to the proper consistence.)—This affords a fine green extract, endowed with the odour and properties of the plant. The dose is from gr. i to grs. v.]

3. *TINCTURA STRAMONII*, D. [U. S.]—*Tincture of Thornapple*.—(Stramonium Seeds, bruised, ℥v [℥ii, U. S.]; Proof Spirit Oij. Macerate for fourteen days, and filter through paper.)—Dose, ℥x to ℥xx twice or thrice a day, gradually increased until it occasions some obvious effect on the system. This preparation is applicable to all the cases for which stramonium is used.

[4. *UNGUENTUM STRAMONII*, U. S.; *Ointment of Stramonium*.—(Take of fresh Stramonium Leaves, cut into pieces, a pound; Lard three pounds; Yellow Wax half a pound. Boil the stramonium leaves in the lard until they become friable; then strain through linen; lastly, add the wax, previously melted, and stir them until they are cold.)—This ointment is used for the same purposes as the belladonna ointment.]

ANTIDOTES.—The same as for belladonna.

174. NICOTIANA TABACUM.—VIRGINIAN TOBACCO.

Sex. Syst. Pentandria, Monogynia.

(Folium, *L.*—Leaves, *E. D.*)

HISTORY.—The inhalation of the fumes of burning vegetable substances, both for causing inebriation and for medicinal purposes, seems to have been very anciently practised. Herodotus³ tells us that the Babylonians and Scythians intoxicated themselves by this means; and both Dioscorides⁴ and Pliny⁵ speak of the efficacy of smoking Tussilago in obstinate cough.

Humboldt⁶ says that the tobacco plant has been cultivated, from time immemorial, by the natives of Oronoko. It does not appear, however, to have been known to Europeans prior to the discovery of America; though it is not improbable that the Asiatics were acquainted with it long before that time, as Pallas, Rumphius, and Loureiro have supposed. But it is not probable, I think, that the Europeans learned the use of it from the Asiatics, as Ulloa has endeavoured to show.

When Columbus and his followers arrived at Cuba, in 1492, they, for the first time, beheld the custom of smoking cigars.⁷ Hernandez de Toledo introduced the plant into Spain and Portugal; and, from the latter place, Joan Nicot sent the

¹ Barker, *Observ. on the Dublin Pharm.*

² Lib. i. *Clio*, ccii.; lib. iv. *Melpomene*, lxxiv. and lxxv.

³ *Hist. Nat. lib.* xxvi. cap. 16, ed. Valp.

⁴ W. Irving, *Hist. of the Life and Voyages of Columbus*, vol. i. p. 2-7; also the Narrative of Don Fernando Colon, son-in-law of Columbus, *Hist. del. Amir.* cap. 27, in Barcia, *Hist. prim. de las Indias occid.* vol. i. p. 24.

⁵ *United States Dispensatory.*

⁶ Lib. ii. cap. 126.

⁷ *Personal Narrative*, vol. v. p. 666.

seeds or the plant to France, about 1559—60.¹ In 1586, on the return of Sir Francis Drake, with the colonists, from Virginia, the practice of smoking was introduced into England; and, being adopted by Sir Walter Raleigh and other courtiers, soon became common.²

Various attempts, by writings, imposts, or bodily punishments, were made in Europe to restrict or put down its use.³ It is said that upwards of a hundred volumes⁴ were written to condemn its employment; and not the least curious of these is the celebrated *Counterblast to Tobacco* of James I.⁵ Despite, and partly, perhaps, as a consequence of these attempts, the use of tobacco rapidly spread, and is now universal throughout the world.⁶

The generic appellation *Nicotiana* is obviously derived from Nicot, the name of an individual above referred to. The origin of the specific name *Tabacum* is less satisfactorily ascertained. It is probable, however, that the word is derived from *tabac*, an instrument used by the natives of America in smoking this herb; though some derive it from *Tobago*, others from *Tabasco*, a town in New Spain.

BOTANY. Gen. Char.—*Calyx* tubular-campanulate, half 5-cleft. *Corolla* hypogynous, funnel-shaped or hypocrateriform; limb plaited, 5-lobed. *Stamens* 5, inserted on the tube of the corolla, inclosed, of equal length; *anthers* dehiscing longitudinally. *Ovary* bilocular; placenta adnate to the dorsal dissepiment; ovules numerous; *style* simple; *stigma* capitate. *Capsule* covered by the persistent calyx, bilocular, septicidal-bivalved at the apex; the valves ultimately bifid, retaining the separated placenta. *Seeds* many, small; the embryo slightly arched, in the axis of fleshy albumen (Endlicher).

Sp. Char.—*Stem* herbaceous. *Leaves* sessile (the lower ones decurrent), oblong-lanceolate, acuminate. Throat of the *corolla* inflated-ventricose; the segments of the limb acuminate (Nees).

A viscid herb. *Root* branching, fibrous. *Stem* 3 to 6 feet high, erect, round, hairy, branching at the top. *Leaves* very large, pale green, with glandular short hairs. *Bracts* linear, acute. *Flowers* paniced on the end of the stem and branches. *Calyx* hairy. *Corolla* rose-coloured. *Ovary* ovate; *style* long and slender; *stigma* capitate, cloven. *Capsule* 2-celled, opening crosswise at the top, loculicidal. *Seeds* numerous, small, somewhat reniform, brown.

Hab.—America. Extensively cultivated in most parts of the world, especially in the United States of America. Virginia is the most celebrated for its culture. North of Maryland the plant is rarely seen.⁷ In England, the cultivation is restricted; not more than half a pole being allowed "in a physis or university garden, or in any private garden for physis or chirurgery."⁸

This is the only species employed in medicine; but the tobacco used for smoking, chewing, and snuff, is derived from several species, the most important of which are the following:—

1. *N. TABACUM*, Linn.; *Common or Virginian Tobacco*.—Of this species several varieties are cultivated.⁹ The Virginian and most other sorts of tobacco imported from the United States of America, as also Colombian tobacco, are obtained from it.

2. *N. LATISSIMA*, Miller; *N. macrophylla*, Sprengel; *Large-leaved or Oronoko Tobacco*.—This species is very closely allied to, if indeed it be not a variety of, the preceding species.¹⁰ Nees¹¹ describes the leaves as being more erect or horizontal than those of *N. Tabacum*, which droop somewhat, and are thicker and more strongly ribbed. Moreover, the lateral nerves of the mid-

¹ Bauhin's *Pinar*.

² Don's *Gardener's Dictionary*, vol. iv. p. 462.

³ *Biograph. Brit.* vol. v. p. 3471; and Clusius, *Exotic*. p. 310.

⁴ Adam Clarke, *Dissert. on the Use and Abuse of Tobacco*, 1797; *Med. and Phys. Journ.* vol. xxiv. p. 451; and C. C. Antz, *Tabaci Hist. Dissert. Inaug.* Berol. 1836.

⁵ *Works*, p. 214, col. 1616.

⁶ *Asiat. Journ.* vol. xxii.

⁷ *United States Dispensatory*.

⁸ London's *Encyclopædia of Agriculture*.

⁹ Schrank (*Botan. Zeitung*, 1807) makes eight varieties, which he respectively calls *attenuatum*, *macrophyllum*, *pullescens*, *alipes*, *serotinum*, *gracilipes*, *Verdon*, and *Lingua*; but it is doubtful whether or not some of these are identical with plants which by others have been described as distinct species.

The cultivated varieties differ in the degree of the thickness of the ribs, of the size and smoothness of the leaf, and in the absence or presence of a petiole (*N. Tabacum* var. *petiolata* is figured in Zenker's *Naturgesch. d. vorzügl. Handelspflanzen*. Bd. ii. Taf. xxxix. 1832).

¹⁰ *Lorensis*, HBK., is probably a variety of *N. Tabacum*.

¹¹ Sprengel, who, in 1807, regarded it as a distinct species, has subsequently (in 1825) declared it to be merely a variety (*Syst. Veget.* vol. i. p. 616).

¹² Geiger's *Handb. d. Pharm.* 2te Aufl. 1839.

rib of *N. latissima* proceed, he says, at right angles; whereas those of *N. Tabacum* are given off at an acute angle.¹ Furthermore, the flowers of *N. latissima* form a dense contracted panicle; whereas those of *N. Tabacum* form a loose spreading one.

This species, like the preceding, has varieties, with broader or smaller, shorter or longer, sessile or stalked leaves. To the latter variety probably belong *N. fruticosa*, Linn., and *N. chinensis*, Fischer.

According to Mr. G. Don,² this species probably yields the large Havana cigars.

3. *N. RUSTICA*, Linn.; *Common Green Tobacco*.—Stem herbaceous, terete. Leaves petiolate, ovate, quite entire. Tube of the corolla cylindrical, longer than the calyx; segments of the limb roundish obtuse.—Corolla greenish-yellow.—Indigenous in America; grows wild in Europe, Asia, and Africa. It grows quicker, ripens earlier, and is more hardy than *N. Tabacum*; and hence it is frequently cultivated in gardens in England, and in several other parts of the world. It is used by peasants as a substitute for the Virginian sort, and by gardeners for the destruction of insects. Nees says that, in smoking, it may be readily distinguished by a peculiar violet odour. Parkinson³ says that, though it is a milder tobacco,⁴ yet he has known Sir W. Raleigh, when prisoner in the tower, prefer it to make good tobacco.—It yields the tobacco of Salonica (the ancient Thessalonica), and probably also that of Latakia (Laodicea), which is so much esteemed. The tobacco called Turkish, grown on the coasts of the Mediterranean, and highly valued in India, is the produce of this species.

4. *N. PERSICA*, Lindl., Bot. Reg. 1592.—Native of Persia. Yields the celebrated Shiraz or Persian tobacco.⁵

5. *N. REPANDA*, Willd.—Native of Cuba, near Havana. The small Havana cigars, or Queen's, are said to be made of this species.

6. *N. QUADRIVALVIS*, Parsh.—Cultivated and spontaneous on the Missouri; principally among the Mandan and Ricara nations.—The tobacco prepared from it is excellent. The most delicate is prepared by the Indians from the dried flowers.

7. *N. NANA*, Lindl., Bot. Reg. t. 833.—Rocky mountains of North America. The Indians are said to prepare the finest of their tobacco from the leaves of this species.

8. *N. MULTIVALVIS*, Lindl., Bot. Reg. t. 1057.—Cultivated by the Indians who inhabit the banks of the Columbia for tobacco, for which purpose the calyx, which is very fetid, is selected in preference to any other part.

CULTURE.—In Virginia and Maryland, the seeds are thickly sown in beds of finely-prepared earth. When the young plants have five or six leaves, exclusive of the seminal leaves, they are transplanted into fields during the month of May, and set three or four feet apart, in rows. During the whole period of growth the crop requires constant attention; and to promote the development of leaves, the tops are pinched off, by which the formation of flowers and seeds is prevented. The harvest is in August. The ripe plants are cut off above their roots, dried under cover, stripped of their leaves, tied in bundles, packed in hogsheads, &c.⁶

DESCRIPTION.—In commerce, two states of tobacco are distinguished—in the one it is called *unmanufactured* or *leaf tobacco*, in the other it is termed *manufactured tobacco*.

1. **UNMANUFACTURED OR LEAF TOBACCO** (*Folia Nicotianæ*).—Tobacco in this state consists of dried leaves, which have a brownish colour, a strong narcotic but peculiar odour, and a bitter nauseous taste. The darker-coloured sorts are the strongest. For medicinal purposes, Virginian tobacco in leaf (*folia tabaci*) should be employed.

In trade, various sorts of unmanufactured or leaf tobacco are met with, and are distinguished by the name of the country from which they are imported into the United Kingdom. The differences between them depend on the species or variety of plant cultivated, on the soil and climate, and on the mode of curing.

1. **UNITED STATES LEAF TOBACCO.**—This constitutes by far the greater proportion of unmanufactured tobacco imported into the United Kingdom. In 1843, no less than 41,038,597 lbs. were imported.

¹ Nees says that by this character several of the commercial sorts of tobacco may be recognized. By himself and other German writers this species is called "Maryland tobacco;" but I find that, though the lateral nerves of the Maryland tobacco of British commerce are given off at a less acute angle than those of the Virginian tobacco, I cannot find any that proceed at a right angle.

² *Gardeners' Dictionary*, vol. iv.

³ *Theatrum Botanicum*, p. 712, 1640.

⁴ Badlicher (*Medicinal-Pflanzen*, p. 333, 1842) declares that it is more stupefying than other species of *Nicotiana*.

⁵ For a notice of the cultivation of Shiraz tobacco, see a paper by Dr. Riach, in the *Trans. of the Horticultural Society*, 2d series, vol. i. p. 205, 1835.

⁶ Loudon's *Encycl. of Agricult.*; Carver, *Treatise on the Cult. of the Tobacco Plant*, 1779.

Several kinds, named from the States where respectively grown, are distinguished in trade; they are as follows:—

The *Virginian* is one of the strongest kinds, and is, therefore, not fit for cigars, but is adapted for pipes and snuff, and for medicinal use. It is imported in leaves or heads contained in hogs-heads. Its colour is deep mottled brown; the leaves feel unctuous. The *Maryland* is paler, yellower, weaker, and adapted for smoking; the *pale cinnamon* is the best, the *scrubs* the commonest. The *Kentucky* is intermediate between the two preceding; it is paler and weaker than the *Virginian*. The *Carolina* is less frequently met with, and is of inferior quality. The *Missouri* and the *Ohio* are other sorts imported from the United States.

2. **CUBA LEAF TOBACCO.**—In 1843, 494,954 lbs. of leaf tobacco were imported from the island of Cuba. The *Havana* sort is most esteemed for smoking; its colour is yellowish-brown; its odour is musky or spicy. It is imported in heads. The *Cuba* is of excellent kind; it is darker than the *Havana*. Both these kinds, as well as the *Colombian*, are remarkable for the light yellow spots on the leaves.

3. **ST. DOMINGO LEAF TOBACCO.**—In 1843, 93,114 lbs. of leaf tobacco were imported from St. Domingo (Hayti). It comes over in leaves, and is deficient in flavour.

4. **PORTO RICO LEAF TOBACCO.**—Small quantities of tobacco in rolls are sometimes imported from this island. In quality, this sort is allied to the *Varinas*.

5. **COLOMBIAN LEAF TOBACCO.**—In 1843, 1,556,206 lbs. of unmanufactured tobacco were imported from Colombia. Three commercial sorts are brought from that country. Like the *Cuba* sorts, the leaves are marked with light yellow spots. The *Colombian* is imported in heads and leaves, and is much esteemed for cigars, for which it is more used than any other kind. It is dark-brown, but not mottled like the *Virginian*. The *Varinas*¹ is brought over in rolls and in hands. It is a mild tobacco, suitable for smoking only. The third sort imported from Colombia is that called *Cumana*. *Orinoco* comes over in leaves.

6. **BRAZILIAN LEAF TOBACCO.**—In 1843, 128,329 lbs. of unmanufactured tobacco were imported from the Brazils.

7. **DUTCH OR AMERSFOORT LEAF TOBACCO.**—In 1843, 55,686 lbs. of unmanufactured tobacco were imported from Holland. Dutch tobacco is very mild, and deficient in flavour. The darker kind is the strongest, and is much esteemed for snuff; while the lighter and weaker kind is employed in the manufacture of the commonest cigars.

8. **LEVANT LEAF TOBACCO.**—*Turkey* tobacco is pale and yellowish. It occurs in small, short, broad leaves, and is the produce of *N. rustica*. It is a weak tobacco, and is cut for smoking. *Latakia* (*Laodicea*) is an esteemed Syrian tobacco, the produce of the same species. *Salonica* is also yielded by *N. rustica*. *Persian* or *Shiraz* tobacco is delicate and fragrant. It is the produce of *N. persica*.

9. **EAST INDIAN LEAF TOBACCO.**—*East Indian tobacco* has never obtained a high repute, doubtless from inattention to its culture and curing.² In 1843, 59,158 lbs. were imported.

10. **MANILLA LEAF TOBACCO.**—In 1843, 2,638 lbs. of unmanufactured tobacco were imported from the Philippine Islands. *Manilla* tobacco is dark coloured, and is much esteemed for cheroots.

2. **MANUFACTURED TOBACCO.**—Under this head are included the different forms of tobacco prepared for chewing and smoking, and for taking as snuff.

1. **Chewing and Smoking Tobaccos.**—Manufacturers distinguish chewing tobaccos and those used in pipes into two kinds, called respectively cut and roll tobacco. For smoking in the pipe, cut tobacco is principally used in England; the roll in Scotland and Ireland. Cigars and cheroots form a third kind.

1. **CUT TOBACCOS.**—These sorts are manufactured by moistening and compressing the leaves of tobacco, and cutting the compressed mass, with knife-edged chopping stamps, into small pieces or shreds varying from 16 to 100 cuts in the inch. By the addition of water (or the *liquor*³), cut tobacco increases in weight from 8 to 16 per cent., according to circumstances. *Shag* tobacco is chiefly prepared from the *Virginian* and *Kentucky* sorts deprived of their stalks or midribs. *Returns*⁴ is a lighter coloured and milder smoking tobacco. It derives its name from its being formerly prepared by returning shag for recutting. *Bird's-eye* is prepared like shag, with the exception that it contains the midribs of the leaves, the slices of which have been compared to the eyes of birds. *Maryland* is another kind of cut tobacco. *Canaster* or *Kanaster* is a favourite kind. It received its name from *canastra* (a Spanish word, signifying a basket),

¹ Sir H. Sloane (*Jamaica*, vol. i. p. lxiii.) says that the tobacco "from Nuevo Reyno de Grenada (corruptly called *Varinas* or *Tubar de Verine*) is reckoned the best."

² Royle, *Essay on the Productive Resources of India*, 1840.

³ It is said that tobaccoists employ, in the preparation of tobacco, a solution of sea-salt (sp. gr. 1.107), which is termed the *sauce* or *liquor*, but I am assured that this is not generally the case. This liquor, it is further stated, is sometimes coloured by treacle or liquorice.

⁴ "Returns of tobacco are the small pieces of broken leaf, and the dust and siftings, produced in the various processes of manufacture." (*Tobacco Report*.)

because it was imported in baskets. It is prepared from Varinas tobacco. *Orinoco*, *Turkey*, *Persian*, and *Varinas*, are also cut tobaccos.

2. **SPUN, ROLL, or TWIST TOBACCOS.**—These are prepared by twisting tobacco into a kind of rope, which is moistened with liquor,¹ and is usually made up into cylindrical or barrel-shaped rolls or sticks, which are subjected to pressure before they are considered fit for sale. *Pigtail*, *Negro-head*, *Bogie*, *Alloa*, *Cavendish*, and *Irish twist*, are roll tobaccos for chewing and smoking. During its manufacture, roll tobacco increases in weight from 15 to 25 per cent.

3. **CIGARS AND CHEROOTS.**—These are small rolls of tobacco permeable to air and adapted for smoking. *Cigars* were originally derived from the New World. They are distinguished from cheroots by their pointed extremity, called the *curl* or *twist*. The *Havana cigars* are in great request by smokers. *Cigars*, however, are extensively made in London. *Cheroots* were originally derived from the East. They are characterized by their truncated extremities. *Mamilla cheroots* are much valued by smokers. *Cheroots*, however, like cigars, are extensively manufactured in London.

2. **Snuffs.**—In the manufacture of snuff, tobacco, cut in small pieces, is first fermented by placing it in heaps and sprinkling it with water or a solution of salt; the latter prevents the tobacco becoming mouldy. The heaps soon become hot and evolve ammonia. The extent to which this process is allowed to proceed varies with different kinds of snuff. The usual time is two or three months, seldom less than one month. The fermented tobacco is then ground in mills, or powdered with a kind of pestle and mortar. The Scotch and Irish are prepared for the most part from the midribs; the Strasburg, French, and Russian snuffs from the soft part of the leaves. The siftings, sometimes termed *thirds*, are usually reground. *Sal ammoniac* is occasionally added to snuffs.

The theory of the *tobacco fermentation* is imperfectly known. Decomposition probably first commences in the albuminous constituent, which yields carbonate of ammonia. The organic salts (malates) next suffer change, and are converted into carbonates. The lignin is the last to decompose; it becomes friable, yields ulmic acid, which colours the tobacco, and a little acetic acid. A portion (perhaps two-thirds) of the nicotina disappears during the process, being either decomposed or volatilized by the aid of the carbonate of ammonia. Moreover, while in the fresh plant the nicotina is found in the state of a salt (malate?) insoluble in ether, in the fermented plant it is found chiefly in the state of acetate or subacetate soluble in ether.

The immense varieties of snuffs found in the shops are reducible to two kinds—dry and moist snuffs.

a. **Dry Snuffs.**—These derive their characteristic property from being dried at a high temperature previous to being ground. *Scotch*, *Irish*, and *Welsh*, are well-known high-dried snuffs. The latter frequently contains lime, the particles of which may be usually distinguished by the naked eye; hence its desiccating effect on the pituitary membrane.² *Spanish snuff* is also a dry snuff. *Brown Scotch* is Scotch snuff moistened after being ground.

β. **Moist Snuffs; Rappees.**—These are snuffs which have been prepared by grinding the tobacco to powder in a moist state. It is sometimes said that pearlash is added to these snuffs to keep them moist, but several respectable manufacturers assure me this is not usual. The rappees of the shops may be divided into three classes: *Simple Rappees*—as *Brown*, *Black*, *Cuba*, *Carotte*, and *Polangero*; *Mixed Rappees*—as *Hardham's Genuine No. 37*; and *Scented Rappees*—as *Prince's Mixture* and *Princeza*, &c.

COMPOSITION.—The juice of the fresh leaves of tobacco was analyzed in 1809 by Vauquelin.³ Subsequently, this chemist analyzed manufactured tobacco.⁴ In 1821, Hernbstädt⁵ discovered *nicotianin*. In 1827, the leaves were analyzed by Posselt and Reimann,⁶ and in 1831 by Dr. Conwell.⁷ In 1845, Messrs. Brande and Cooper⁸ made a series of experiments to ascertain the proportion of soluble and insoluble matters in eight samples of tobacco.

¹ Water and oil are alone allowed by law to be used in the manufacture of roll tobacco; but sugar, molasses, and liquorice are frequently employed.

² The Act of Parliament allows lime-water to be used in the manufacture of Irish and Welsh snuffs; but Mr. Foot (*Tobacco Report*) states that the Lundyfoot or "high-toast snuff" is made of the stalks and leaves of tobacco and water (which latter is afterwards got rid of by drying) without lime.

³ *Ann. de Chim.* lxxi. 139.

⁴ Schweigger's *Journ. für Chem.* xxxi. 441.

⁵ *Silliman's Journ.* xvii. 369.

⁶ *Annal. du Mus. d'Hist. Nat.* t. xiv.

⁷ *Gmelin, Handb. d. Chem.* ii. 1393.

⁸ Brande's *Manual of Chemistry*, p. 1623, 1545.

Vauquelin's Analysis.

An acrid volatile principle (*nicotina*).
Albumen.
Red matter, soluble in alcohol and water.
Acetic acid.
Supermalate of lime.
Chlorophylle.
Nitrate of potash and chloride of potassium.
Sal ammoniac.
Water.

Expressed juice of the leaves.

The leaves contained, in addition to the above, woody fibre, oxalate and phosphate of lime, oxide of iron, and silica. The two latter substances were obtained from the ashes.

Manufactured tobacco contained the same principles, and, in addition, carbonate of ammonia and chloride of calcium, perhaps produced by the reaction of sal ammoniac and lime, which are added to tobacco to give it pungency.

Posselt and Reinmann's Analysis.

Nicotina	0.06
Concrete volatile oil (<i>nicotianin</i>)	0.01
Bitter extractive	2.87
Gum with malate of lime	1.74
Chlorophylle	0.267
Albumen and gluten	1.308
Malic acid	0.51
Lignin and a trace of starch	4.969
Salts (sulphate, nitrate, and malate of potash, chloride of potassium, phosphate and malate of lime, and malate of ammonia) . . .	0.734
Silica	0.058
Water	88.280

Fresh leaves of tobacco 100.836

Conwell's Analysis.

Gum.
Mucilage soluble in both water and alcohol.
Tannin.
Gallic acid.
Chlorophylle.
Green pulverulent matter, soluble in boiling water.
Yellow oil, having the odour, taste, and poisonous properties of tobacco.

Pale yellow resin (large quantity).
Nicotina.
A substance analogous to morphia.
An orange-red colouring matter.
Nicotianin.

1. NICOTINA (*Nicotine*). Symbol Ni. Formula $C^{20}H^{14}N^2$. Eq. Wt. 162.—Exists not only in the leaves (both fresh and fermented), but also in the root¹ and in the seeds,² as well as in the smoke of tobacco. It is obtained by digesting an aqueous extract of the leaves in rectified spirit, which takes up the nicotina salts. The decanted tincture is to be concentrated, mixed with a solution of potash, and briskly shook with ether, which dissolves the nicotina set free by the potash. To purify the alkaloid, add gradually to its solution oxalic acid in powder; oxalate of nicotina, insoluble in ether, forms, at the bottom of the vessel, a syrupy layer, which is to be repeatedly shaken with pure ether. The nicotina may be separated by potash and ether, as before. The ethereal solution is to be distilled in a salt-water bath, then transferred to a retort, through which a current of dry hydrogen circulates; exposed to a temperature of 284° F. in an oil bath, in order to entirely get rid of the water, ether, and ammonia; lastly, the temperature is to be raised to 356°, when the nicotina distils over drop by drop. From 28 lbs. of Virginia tobacco, at least 4 per cent. of nicotina can be obtained by this process.

Nicotina is a colourless liquid alkaloid, with an acrid odour and an acrid burning taste. Its density is 1.024. It restores the blue colour of reddened litmus, and renders turmeric brown. It does not solidify at 14° F.; it boils at 482° F., and at the same time undergoes decomposition. By exposure to the air it becomes brown and thick. It is readily combustible with the aid of a wick. It is soluble in water, ether, alcohol, and the oils (fixed and volatile). It combines with acids, and forms very deliquescent salts; the *sulphate*, *phosphate*, *oxalate*, and *tartrate*, are crystallizable; the *acetate* is not. A dilute aqueous solution of nicotina yields a white flocculent precipitate (double chloride) with a solution of bichloride of mercury, and a yellow granular precipitate with chloride of platinum.

Nicotina is an energetic poison, almost equalling in activity hydrocyanic acid.³

The amount of nicotina in leaf or manufactured tobacco may be estimated by Schloesing's process.⁴ Exhaust two drachms of tobacco by ammoniacal ether in a continuous distillatory apparatus, expel the ammoniacal gas from the nicotina solution by boiling, then decant, and after the evaporation of the ether, estimate the amount of nicotina in the residue by the quantity of diluted sulphuric acid of known strength required to saturate it.

The following are the amounts found in various French and American tobaccos:—

100 Parts of Tobacco dried at 212°.	Nicotina.
Virginia	6.87
Kentucky	6.09
Maryland	2.29
Havana (cigars primera), less than	2.00
Lot	7.96
Lot-et-Garonne	7.34
Nord	6.58
He-et-Vilaine	6.29
Pas-de-Calais	4.94
Alsace	3.21
Tobacco in powder	2.04

¹ E. Davy, *Lond. and Ed. Phil. Mag.* vol. vii. p. 393.

² Buchner, *Repert. Bd.* xxxii.

³ An interesting case of poisoning by nicotina has recently occurred in Belgium. See Orfila, *Repert. de Pharmaco.* June, 1851.

⁴ *Chemical Gazette*, vol. v. p. 41, 1847.

2. **ACIDS OF TOBACCO.**—Tobacco is very rich in malic acid; it also contains citric and phosphoric acids, and according to M. Barral, a peculiar acid which he terms *nicotianic acid*.

3. **CONCRETE VOLATILE OIL OF TOBACCO** (*Nicotianin*, Hermbstädt; *Tobacco-camphor*, Gmelin). Obtained by submitting tobacco leaves, with water, to distillation. Six pounds of the leaves yielded eleven grains of oil, which swims on the surface of the liquor. This oil is solid, has the odour of tobacco, and a bitter taste. It is volatile, insoluble in water and the dilute acids, but soluble in ether and caustic potash. According to Landerer,¹ fresh tobacco leaves yield no nicotianin, which, therefore, would appear to be developed by the drying of the leaves under the influence of air and water. Nicotianin excites, in the tongue and throat, a sensation similar to that caused by tobacco smoke. Hermbstädt swallowed a grain of it, and experienced, soon after, giddiness, nausea, and inclination to vomit. Applied to the nose it causes sneezing.

4. **ASHES OF TOBACCO.**—Tobacco yields a very large amount of ashes, but both the quantity and quality of which vary considerably. The ashes obtained from the leaves (including the ribs) vary from 17 to 27 per cent.²

5. **TOBACCO SMOKE.**—The constituents of tobacco smoke, according to Raab,³ are much carbonate of ammonia, acetate of ammonia, nicotianin, empyreumatic oil, carbonaceous matter (soot), moisture and several gases. Unverdorben obtained,⁴ by the dry distillation of tobacco, water, oil, and resin. These products consisted of a volatile oil, an oleaginous acid, an empyreumatic acid, (Brandsäure), resin, traces of a powder insoluble in potash and acids, a small quantity of odorous, a base soluble in water (nicotin?), fuscine, red matter soluble in acids, and two extractive matters, one forming a soluble, the other an insoluble compound with lime.

But, more recently, Zeise⁵ has submitted tobacco smoke to a careful analysis, and gives the following as its constituents: A peculiar empyreumatic oil, butyric acid, carbonic acid, ammonia, paraffine, empyreumatic resin, water, probably some acetic acid, more or less carbonic oxide, and carburetted hydrogen. To the absence of creasote is, perhaps, to be ascribed the less acrid quality of tobacco smoke than of wood smoke. Melsens⁶ has subsequently directed *nicotina* in tobacco smoke.

The purified empyreumatic oil of tobacco passes over colourless, but soon becomes yellowish, and ultimately brownish. Its sp. gr. is 0.870. It is soluble in alcohol and in ether, but not in water. Its composition is $C^{14}H^{14}O^2$.—In the impure state, Dr. Morries⁷ describes the oil as being rather less solid than the empyreumatic oil of foxglove (see p. 457); but it is undistinguishable from the latter by either taste or smell. In this state it probably contained some nicotina. It has been suggested that this oil is "*the juice of cursed hebenon*," alluded to by Shakespeare,⁸ who also calls it a "*distilment*."

CHARACTERISTICS.—The characteristics of tobacco leaves are partly botanical, partly chemical.

The botanical characters which apply to large and perfect leaves have been before stated (see *ante*, p. 486); those used to detect small fragments will be noticed under the head of adulterations (see *infra*).

The following are the chemical characters, as given by Dr. Ure,⁹ of a filtered cold infusion of tobacco, prepared by macerating 100 grs. of dried Virginia tobacco in 1000 grs. of distilled water: "Infusion pale brown; acid reaction with litmus paper; nitrate of barytes, 0; nitrate of silver, a faint opalescence, but no curdy precipitate; oxalate of ammonia, a faint cloud of calcareous matter; water of ammonia, 0; chloride of tin, a faint white precipitate—hence no sulphuretted hydrogen present; chloride of platinum, a copious white precipitate, from the ammoniacal salt present; acetate of lead, an abundant whitish precipitate, soluble in nitric acid; chloride of iron caused a green tint, and sulphate of copper an olive brown, both resulting from the yellow of the iron, and blue of the copper solutions, with the brown of the tobacco."

The mode of determining the percentage quantity of nicotina in tobacco has been already mentioned (see *ante*, p. 489).

The peculiar odour of tobacco smoke, as well as the remarkable sensation of acridity which both it and tobacco leaf excite in the throat, may sometimes aid in the detection of tobacco. (See, on this subject, *Lobelia inflata*.)

¹ Pharm. Central-Blatt für 1835. S. 690.

² Johnston's Lectures on Agricultural Chemistry, p. 391, 1817.

³ Zenker and Schenk, Naturgesch. d. vorzügl. Handelspfl. Bd. ii. S. 75.

⁴ Poggendorff's Annalen, viii. 399.

⁵ Ann. de Chim. et de Physiq. 3me sér. t. ix. p. 465.

⁶ Edinb. Med. and Surg. Journ. vol. xxxix. p. 379.

⁷ Supplement to his Dictionary, p. 251.

⁸ Hamlet, Act i. Scene 5.

ADULTERATION.—From the evidence laid before a committee of the House of Commons in 1844, it appears that adulteration of tobacco has been (and probably still is) very general, and has varied from 5 to 40 per cent.; in some cases being carried as far as 100 per cent. of the tobacco.

The substances used for adulterating are numerous and various. *Water* being necessary, in the manufacture of tobacco, and being allowed by law, can scarcely be called an adulterating ingredient, though it serves to increase the weight of the tobacco. In the preparation of Shag tobacco, about 12 per cent. of water is used in this country.¹ *Saccharine matter* (sugar, molasses, honey, &c.), which is the principal adulterating ingredient, is said to be used both for sophistication and for rendering the tobacco more agreeable. *Vegetable leaves* (as of rhubarb and beech), *mosses, bran, malt-combs* (sprout of the malt), *beetroot dregs, liquorice, terra japonica, rosin, salts* (nitre, common salt, and sal ammoniac), *yellow ochre, fuller's earth, and sand*, are stated (see the *Tobacco Report*) to have been employed as adulterating agents.

The detection of adulteration is in some cases easy, in others difficult, if not impossible.² Two methods of analysis have been resorted to; one mechanical, the other chemical.³

The presence of foreign bodies may sometimes be detected by the naked eye, at other times the use of a magnifying-glass or microscope is necessary to detect them. Tobacco leaves present several remarkable (though not peculiar) characters which lend important aid in detecting adulterations: these are—1st, the horseshoe or crescentic mark seen on a transverse section of the leaf-stalk;⁴ 2dly, the glandular character of the hairs;⁵ 3dly, the size and shape of the meshes or reticulations of the epidermis;⁶ 4thly, the size shape, and number, in a given space, of stomata.

The chemical characters or tests on which reliance has been placed in detecting adulterations are chiefly the following: 1st, the relative proportions of matters soluble and insoluble in water. The substances insoluble in water are called by the excise officers "ligneous matters," and for Virginia, Missouri, and Kentucky tobacco amount to from 45 to 55 per cent. Porto Rico tobacco, however, yields 70 per cent. of ligneous matters. The matters soluble in water are termed "extractive," and, of course, make up the difference. It is obvious, however, that no reliance can be placed on this test (on account of the great variations in the proportions of the two constituents) unless a portion of the pure leaf, from which the suspected manufactured tobacco was made, can be obtained for comparison.⁷ 2dly, genuine tobacco mixed with yeast and water, and submitted to a proper temperature, does not undergo the vinous fermentation; but tobacco which has been adulterated with saccharine matter undergoes this kind of fermentation and yields alcohol (see *ante*, p. 150).⁸ Trommer's test is employed to distinguish grape sugar and molasses

¹ On the continent, tobacco is more coarsely cut, and, therefore, less water is required in its manufacture.

² Dr. Ure, in his evidence (Quest. 8849), states that he is quite sure that he "could so adulterate tobacco as to elude every chemical and microscopical examination."

³ Mr. Richard Phillips, Professor Graham, and Mr. George Phillips, employed mechanical means chiefly in the analysis of various samples (some adulterated, others unadulterated) of tobacco submitted to their examination by the Parliamentary Committee (Quest. 7511—12).

⁴ The horseshoe or crescentic mark seen in the centre of the leaf-stalk of tobacco is the mass of woody fibres and vessels which eventually make the veins of the leaf. This character, though much relied on by the excise officers, is not peculiar to tobacco—being found in stramonium, belladonna, and some other leaves. It is, however, absent in rhubarb leaves.

⁵ The hairs of tobacco leaves are tipped by a small spherical or ellipsoidal gland. In rhubarb and potato leaves, the hairs are lymphatic, not glandular.

⁶ In tobacco, the meshes seen on the epidermis are bounded by sinuous lines.

⁷ Dr. Ure (Quest. 8770) declares that the amount of residuum or ligneous matter is as variable from the genuine tobacco as from adulterated specimens furnished him by the Parliamentary Committee; and he, therefore, declares this test as good for nothing.

⁸ Dr. Ure objects to the fermentation test that it might be rendered nugatory by adding to the tobacco substances which are known to prevent fermentation in sugar (see *ante*, p. 81, footnote 8). Thus it has been long known in Burgundy that a little red precipitate of mercury, when added to must (juice of the grape), prevents fermentation. He also observes (*Supplement to his Dictionary*, p. 253), that it would result from experiments made by Professor Graham and Messrs. Phillips, that infusions of tobacco without sugar, when mixed with brisk yeast, and placed for forty hours in a temperature of about 50° F., undergoes a certain degree of decomposition, attended with a diminution of their specific gravity; or, in the language of the Excise, they suffer attenuation.

from cane sugar (see *ante*, p. 150). 3dly, treating the samples with alcohol, and examining the alcoholic solution and the parts insoluble in alcohol. 4thly, incinerating the suspected sample, and determining the amount and nature of the ashes. According to Mr. Johnston,¹ the percentage of ash left by the dry tobacco leaf varies from 19 to 27 per cent. of its whole weight; Pelouze and Frémy,² on the other hand, state that for leaves and ribs dried at 212° it varies from 17 to 24 per cent., and for stalks from 6 to 16 per cent. The nature and solubility of the ashes, and the proportion of silica in them, are subject to great variation.³ 5thly, the determination of the amount of nitrogen; but Dr. Ure,⁴ who suggested this line of research, has satisfied himself that this method can serve no good purpose. 6thly, special tests are required for the detection of particular substances suspected to be present. Thus for *terra japonica* the tests employed are the salts of iron and gelatine, by which the presence of astringent matter is indicated.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—In the *carnivora*, tobacco causes nausea, vomiting, sometimes purging, universal trembling, staggering, convulsive movements, and stupor. Five drachms and a half of rappee introduced into the stomach of a dog, and secured by a ligature on the œsophagus, caused death in nine hours. In another experiment, two drachms applied to a wound killed the animal in an hour.⁵ Sir B. Brodie⁶ found that the infusion of tobacco, thrown into the rectum, paralyzed the heart, and caused death in a few minutes. But if the head of the animal be previously removed, and artificial respiration kept up, the heart remains unaffected; proving that tobacco disorders this organ through the medium of the nervous system only. In the *herbivora*, the effects of tobacco, as of other vegetable poisons, are much less marked; vomiting does not occur. Schubarth⁷ gave four ounces of the leaves to a horse, at three times within two hours. The pulse became irregular, then slower, afterwards quicker; respiration and the pupils were scarcely affected. For two days the stools and urine were more frequent. Moiroud⁸ observed no remarkable effect from the exhibition of a decoction of four ounces of tobacco to a horse.

It is remarkable that the *emphyreumatic oil of tobacco* does not possess the same power of paralyzing the heart. Applied to the tongue of a cat, one drop caused convulsions, and in two minutes death; on opening the body, the heart was beating regularly and with force.⁹ Its operation, therefore, is analogous to that of hydrocyanic acid. Dr. Morries¹⁰ says it has less tendency to induce convulsions than the emphyreumatic oils of foxglove, henbane, or the thornapple.

β. On Man.—In small doses, tobacco causes a sensation of heat in the throat, and sometimes a feeling of warmth at the stomach; these effects, however, are less obvious when the remedy is taken in a liquid form, and largely diluted. By repetition it usually operates as a diuretic, and less frequently as a laxative. Accompanying these effects are oftentimes nausea and a peculiar feeling usually described as giddiness, but which scarcely accords with the ordinary acceptance of this term. As dropsical swellings sometimes disappear under the use of these doses, it has been inferred that the remedy promotes the operation of the absorbents. In larger doses, it provokes nausea, vomiting, and purging. Though it seldom gives rise to abdominal pain, it produces a most distressing sensation of sinking at the pit of the stomach. It occasionally acts as an anodyne, or more rarely promotes sleep. But its most remarkable effects are languor, feebleness, relaxation of muscles, trembling of the limbs, great anxiety, and tendency to faint. Vision is frequently enfeebled, the ideas confused, the pulse small and weak, the respiration somewhat laborious, the surface cold and clammy, or bathed in a cold sweat, and, in extreme cases,

¹ *Lectures on Agricultural Chemistry*, p. 391, 1847.

² *Cours de Chimie Générale*, t. iii. p. 232, 1850.

³ Will and Fresenius, *Mem. of the Chemical Society*, vol. ii. p. 191; and Beauchef, in Pelouze and Frémy, *op. supra cit.* pp. 233 and 234.

⁴ *Tobacco Report*, p. 460; and *Supplement to his Dictionary*, p. 250, 1844.

⁵ Orfila, *Tox. Gén.*

⁶ *Phil. Trans.* for 1811, p. 178.

⁷ Wilmber, *Wirk. d. Arzneim. u. Gift.* Bd. iii. S. 336. ⁸ *Pharm. Vét.* p. 364.

⁹ Brodie, *op. cit.*

¹⁰ *Ed. Med. and Surg. Journ.* vol. xxxix. p. 383.

convulsive movements are observed. In excessive doses, the effects are of the same kind, but more violent in degree. The more prominent symptoms are nausea, vomiting, and in some cases purging, extreme weakness and relaxation of the muscles, depression of the vascular system (manifested by feeble pulse, pale face, cold sweats, and tendency to faint), convulsive movements, followed by paralysis and a kind of torpor, terminating in death.

Taken in the form of *snuff*, its principal effect is topical. It causes increased secretion of nasal mucus, and, in those unaccustomed to its use, sneezing. Getting into the throat it produces a feeling of acidity, and sometimes nausea. From some kinds of rappee I have experienced giddiness and great prostration of strength. Lanzoni¹ states that an individual fell into a state of somnolency, and died lethargic on the twelfth day, in consequence of taking too much snuff. Reasonable doubt, however, may be entertained, I think, whether these accidents really arose from snuff. The habitual use of this substance blunts the sense of smell and alters the tone of voice; but I am unacquainted with any other well-ascertained effects, though Cullen² ascribes loss of appetite and dyspepsia to it; and Dr. Prout³ observes, that "the severe and peculiar dyspeptic symptoms sometimes produced by inveterate snuff-taking are well known; and I have more than once seen such cases terminate fatally with malignant diseases of the stomach and liver." I have known several inveterate snuff-takers who, after many years' use of this substance, have discontinued it with impunity; but Dr. Cullen thinks, that when the discharge of mucus is considerable, the ceasing or suppression of it, by abstaining from snuff, is ready to occasion the very disorders of headache, toothache, and ophthalmia, which it had formerly relieved. There do not appear to be any good grounds for the supposed baneful effects of the manufacture of snuff on the workmen.⁴ Sir W. Temple⁵ recommends the introduction of a tobacco leaf into the nostrils for the relief of affections of the eyes and head.

The *smoking* of tobacco by those unaccustomed to it, gives rise to all the before-described effects of large and excessive doses. A very interesting case, which had almost terminated fatally, is related by Dr. Marshall Hall.⁶ It was that of a young man, who, for his first essay, smoked two pipes. Gmelin⁷ mentions two cases of death from smoking, in the one of seventeen, in the other of eighteen pipes at a sitting.

In habitual smokers, the practice, when employed moderately, provokes thirst, increases the secretion of saliva and buccal mucus, and produces a remarkable soothing and tranquillizing effect on the mind, which has made it so much admired and adopted by all classes of society, and by all nations civilized and barbarous. I am not acquainted with any well-ascertained ill effects resulting from the habitual practice of smoking. A similar observation is made by Dr. Christison.⁸ Yet Dr. Prout says it "disorders the assimilating functions in general, but particularly, as I believe, the assimilation of the saccharine principle. I have never, indeed, been able to trace the development of oxalic acid to the use of tobacco; but that some analogous and equally poisonous principle (probably of an acid nature) is generated in certain individuals by its abuse, is evident from their cachectic looks, and from the dark, and often greenish-yellow tint of their blood."⁹ There do not appear to be any good grounds for supposing that smoking is a prophylactic against contagious and epidemic diseases—an opinion at one time entertained.

The practice of *chewing* tobacco is principally confined to sailors, and is less frequently submitted to our observation; so that we are not so competent to speak of its effects, which, probably, are similar to those caused by smoking.

The application of tobacco to abraded surfaces is a very dangerous practice, and has in some instances been attended with violent or even fatal results. Mr. Wes-

¹ Christison, *On Poisons*.

² *On the Nature and Treatment of Stomach and Urinary Diseases*, p. 25.

³ Christison, *op. cit.*

⁴ *Edinb. Med. and Surg. Journ.* vol. xii. p. 11.

⁵ *Op. cit.* p. 771.

⁶ *Mat. Med.* ii. p. 274.

Lond. 1840.

⁷ *Letters*, p. 286, folio, 1720.

⁸ Quoted by Christison.

⁹ *Op. supra cit.* p. 25.

ton¹ has related a case in which the expressed juice of tobacco was applied to the head of a boy, aged eight years, for the cure of tinea capitis. Death took place three hours and a half after the application.

In the form of *clyster*, tobacco has frequently proved fatal, sometimes from the use of inordinate doses by ignorant persons,² and occasionally in the hands of the well-informed practitioner. Desault³ has witnessed the smoke prove fatal. Sir A. Cooper⁴ has seen two drachms, and even one drachm, destroy life. In a case related by Sir Charles Bell⁵ death probably occurred from the same cause. Dr. Copland⁶ saw half a drachm in infusion prove fatal.

The operation of tobacco resembles that of *Lobelia inflata* (see LOBELIACEÆ). With foxglove, tobacco agrees in several circumstances, especially in that of enfeebling the action of the vascular system, though its power in this respect is inferior to that of foxglove. In its capability of causing relaxation and depression of the muscular system, and trembling, tobacco surpasses foxglove; as it does, also, in its power of promoting the secretions. From belladonna, stramonium, and hyoscyamus, it is distinguished by causing contraction of the pupil, both when applied to the eye and when taken internally in poisonous doses; and also by the absence of delirium and of any affection of the parts about the throat. Vogt⁷ and Sundelin⁸ have considered the effects of tobacco as closely allied to those of aconite; but to me the resemblance is less obvious (see RANUNCULACEÆ). The power possessed by the last-mentioned substance of paralyzing the sentient nerves sufficiently distinguishes it from tobacco.

USES.—The principal remedial value of tobacco consists in its power of relaxing muscular fibres, whereby it becomes a valuable antispasmodic. As a purgative, but especially as an antispasmodic and purgative conjoined, it is exceedingly serviceable in alvine obstructions. As a sedative to the vascular system it has not been much used. I tried it somewhat extensively a few years since, as a substitute for blood-letting, in inflammatory affections; but, while it produced such distressing nausea and depression that it was with difficulty I could induce patients to persevere in its use, I did not find its antiphlogistic powers at all proportionate, and eventually I discontinued its employment. As an anodyne, diuretic, or emetic, it is much inferior to many other articles of the *Materia Medica*.

1. In *colic*, *ileus* (*volvulus*), *strangulated hernia*, and *constipation*.—The efficacy of tobacco in these diseases depends principally on its power of relaxing muscular fibres and on its purgative properties. These effects are usually accompanied by nausea and giddiness. The remedy is applied in the form of *clyster*, consisting either of the infusion or of the smoke. The latter was at one time supposed to be more efficacious. Heberden⁹ says it causes less giddiness than the infusion. It probably extends farther up the intestines than the liquid enema, and, therefore, acts on a larger surface. But the difficulties and inconvenience of applying it, and the uncertainty of its effects, have led, for the most part, to the discontinuance of its use. In *ileus*, the tobacco *clyster* has been recommended by Sydenham,¹⁰ by Heberden,¹¹ by Abercrombie,¹² and by several other distinguished authorities. The earlier it is resorted to, the more successful is it likely to prove. Indeed, when employed in the last stage of the disease, it sometimes hastens the fatal termination by exhausting the already depressed vital powers. As it is occasionally necessary to repeat the injection, it is of importance to begin cautiously. Dr. Abercrombie uses only fifteen grains of tobacco infused in six ounces of boiling water for ten minutes, and he repeats this in an hour if no effect have been produced. I have generally employed a scruple, and have not experienced any dangerous effects from

¹ *Med. and Phys. Journ.* vol. xiv. p. 305.

² *Œuvres Chir.* t. ii. p. 314.

³ *Surgical Observations*, part ii. p. 189.

⁴ *Pharmacodyn.*

⁵ *Comment. on the Hist. and Cure of Diseases*, 3d edit. p. 270, 1806.

⁶ *Whole Works*, 4th edit. by Peechey, p. 428.

⁷ *Op. cit.*

⁸ Christison, *op. cit.*

⁹ *Anatomy and Treatment of Hernia*, p. 24.

¹⁰ *Dict. of Pract. Med.* art. *Colic*, vol. i. p. 371.

¹¹ *Handb. d. spec. Heilmittell.*

¹² *On Diseases of the Abdominal Viscera.*

its application; and it is possible that, in persons long accustomed to the use of tobacco, a somewhat larger dose might be required; but I have never met with any cases in which a scruple did not produce the full effect on the system that was desired. In *strangulated hernia*, the tobacco clyster has frequently effected the return of the protruded parts when the operation appeared almost inevitable; and every surgical writer speaks in the highest terms of its use. A tense hernial tumour sometimes becomes soft and relaxed by the diminished force of circulation produced by tobacco. Notwithstanding these facts, this remedy is much less resorted to than formerly. Three circumstances have, I suspect, led to the infrequency of its use—first, the dangerous, if not fatal, consequences which have sometimes resulted from its employment; secondly, the frequency of its failure, and the consequent loss of time, by which the chance of recovery is diminished; thirdly, the operation for hernia being much less dreaded now than formerly, for experience has fully proved that death rarely (Mr. Pott says only once in fifty times) results from it. In *colic* from lead, and in *obstinate constipation* from spasmodic constriction, the tobacco clyster has sometimes proved most beneficial. Of the application, in lead colic, of compresses soaked in a strong decoction of tobacco, to the abdomen, as recommended by Dr. Graves,¹ I have no experience. The practice is, of course, calculated to be beneficial, but is less certain and speedy in its effect than tobacco clysters.

2. In *ischuria* and *dysuria*.—When retention of urine arises from spasm of the neck of the bladder, or from spasmodic stricture, tobacco, by its powerfully relaxing properties, is an agent well calculated to give relief. Mr. Earle² has published several cases illustrative of its efficacy. In dysury, also, tobacco proves serviceable; it abates pain, relaxes the urinary passages, promotes the secretion of urine, and, by diminishing the sensibility of the parts, facilitates the expulsion of calcareous matter.³

3. *Tetanus*.—The relaxing influence over the muscular system possessed by tobacco, suggested the employment of this remedy in tetanus. Its effects have been, like those of most other medicines in this disease, unequal. Sir J. Macgregor⁴ says, that in the advanced stage of the malady the tobacco clyster had no effect. Mr. Earle⁵, however, thought it afforded temporary alleviation in a case in which he tried it. Since then, several cases have been successfully treated by tobacco. Dr. O'Beirne⁶ obtained most marked relief by its use. He employed it in the form of clyster (containing a scruple of tobacco), which was repeated once or thrice or oftener daily during eighteen days; and it was observed that if by design or accident the remedy was discontinued, the spasms recurred with force. Mr. Anderson⁷ employed a decoction of the fresh leaves in the form of enema, and both with good effect. Mr. Curling⁸ has collected accounts of nineteen cases (including those of Earle, O'Beirne, and Anderson, above referred to) treated by tobacco; of these, nine recovered; and in seven of the fatal cases the remedy had not a fair trial; while in the eighth, organic disease of the brain was found. Mr. Curling observes, that "more has now been advanced in proof of the efficacy of tobacco than can be adduced in favour of any other remedy yet resorted to. I have not," he adds, "succeeded in finding a single case in which, being fully and fairly tried before the constitution had given way, it has been known to fail."⁹

4. *Other spasmodic diseases*.—The success attending the use of tobacco in tetanus has led to its employment in *hydrophobia*, but hitherto without avail. In a case of periodical *epilepsy*, Dr. Currie¹⁰ prevented the return of the disease by the application of a tobacco cataplasm to the scrobiculus cordis half an hour before the expected paroxysm. In a very bad case of *spasm of the rima glottidis*, which resisted powerful depletion by the lancet, Dr. Wood¹¹ applied with success a tobacco

¹ *Dublin Hospital Reports*, vol. iv.

² Fowler, *Med. Rep. of the Effects of Tobacco*, 1785.

³ *Med.-Chir. Trans.* vol. vi. p. 456.

⁴ *Dublin Hospital Reports*, vol. iii.

⁵ *Treatise on Tetanus*, p. 168. 1836

⁶ *Med. Rep.* vol. i. p. 163.

⁷ *Med.-Chir. Trans.* vol. vi. p. 82.

⁸ *Ibid.* p. 92.

⁹ *Edinb. Med.-Chir. Trans.* vols. i. and ii.

¹⁰ *Op. cit.* p. 177.

¹¹ *United States Dispensatory*.

cataplasm to the throat. In *spasmodic asthma*, tobacco, either smoked or taken internally, in nauseating doses, has been found occasionally to give relief. My own observation is unfavourable to the use of tobacco smoke, which I have repeatedly found to bring on convulsive cough and spasmodic difficulty of breathing in persons afflicted with chronic catarrh. Dr. Sigmond¹ says the tincture of tobacco has been sold and used to a great extent under the name of tincture of lobelia, and that it proved successful in spasmodic asthma. In *rigidity of the os uteri*, a tobacco clyster failed to produce relaxation, while it caused alarming constitutional symptoms.²

5. In *dropsy*.—Tobacco was recommended as a diuretic in dropsy by Dr. Fowler,³ who published a number of cases of anasarca and ascites which had been relieved by it.⁴ Whatever benefit may have been obtained, in these cases, by the use of tobacco, should be ascribed, I suspect, rather to the sedative powers of this agent than to its influence over the kidneys. In small doses it is an uncertain diuretic, and in larger doses it causes such distressing nausea and depression that practitioners have long since ceased to use it in dropsical cases. The ashes of the tobacco plant have also been used in dropsy.⁵

6. As a *topical remedy*.—Dr. Vetch⁶ recommends the infusion, as an anodyne and sedative topical application, in gouty and rheumatic inflammation of the joints, testicle, and sclerotic coat of the eye, and in erysipelatous inflammation. Bergius⁷ recommends a fomentation of tobacco leaves in phymosis and paraphymosis. An infusion or ointment of tobacco has been used in porrigo and other skin diseases, as well as in some obstinate ulcers. The smoke, applied to the hair, is a popular means of destroying pediculi, and has been used, in the form of clyster, to destroy ascarides. Dr. Sigmond⁸ says tobacco promotes the growth of the hair. Toothache has been relieved by tobacco smoke.

In addition to the preceding, there are various other diseases against which tobacco has been employed. Thus in *soporose affections* and *asphyxia*, tobacco clysters have been employed, but they are more likely to do harm than good. Tobacco has also been used as an *anthelmintic*.

ADMINISTRATION.—Tobacco is rarely administered *in substance*. Five or six grains of snuff have been taken as an emetic, and are said to have operated as effectually as two grains of emetic tartar. For internal administration the *wine of tobacco* is generally employed. Dr. Fowler used an *infusion* (prepared with an ounce of Virginian tobacco to a pound of boiling water), which he gave in doses of from sixty to a hundred drops. The best time for administering it he found to be two hours before dinner, and at bedtime. The usual *tobacco enema* is the infusion prepared according to the Pharmacopœia. The *tobacco smoke clyster* (*clyster e fumo tabaci*) is applied by means of a proper apparatus, formerly kept by the instrument-makers. Various extemporaneous methods of employing it have been devised.⁹ For external use tobacco is used in the form of *cataplasm* (made of the leaves and water and vinegar), *infusion* (the *tobacco water* of the shops), *smoke*, and *ointment*: all these, however, require great caution in their use, especially when applied to abraded surfaces.

ANTIDOTES.—If the poison have been swallowed, let the contents of the stomach be withdrawn as speedily as possible. No chemical antidote has as yet been demonstrated; but the vegetable astringents (infusion of nutgalls, green tea, &c.) deserve examination. As anti-narcotics, the vegetable acids and coffee may be administered. The other parts of the treatment must be adapted to circumstances. When the depression of the vascular system is extreme, ammonia and brandy may be administered with good effect, and frictions employed; even acupuncture of the heart (!) has been suggested.¹⁰ Artificial respiration should not be omitted when other means

¹ *Lancet* for 1836—7, vol. ii. p. 253—4.

² Dr. Dewees, *Comp. Syst. of Midwif.* p. 378, 1825.

³ See also Garnett, in *Duncan's Med. Comment.* for 1797, Dec. 11, vol. vi.

⁴ Garden, in *Duncan's Med. Comment.* Dec. 1, vol. iii.

⁵ *Mat. Med.* i. 232.

⁶ Murray, *App. Med.* t. i.

⁷ *Op. supra cit.*

⁸ *Med.-Chir. Trans.* vol. xvi. p. 356.

⁹ *Lancet*, vol. ii. p. 249, 1826—7.

¹⁰ Stephenson and Churchill, *Med. Bot.*

have failed. If apoplectic symptoms present themselves, bloodletting may, perhaps, be requisite, as in the case related by Dr. M. Hall.

1. ENEMA TABACI, L. E. D.; *Infusum Tabaci* [U. S.]; *Tobacco Clyster*.—(Tobacco ℥j [grs. xv to 3ss, E.]; Boiling Water Oss [f℥viij, E. D.]. Macerate for an hour [half an hour, E.], and strain.)—The want of uniformity in the formulae of the British Colleges is greatly to be regretted; and I cannot but think that the latitude permitted by the Edinburgh College, in the quantity of tobacco employed, is highly objectionable, and calculated to lead to serious errors in dispensing. The tobacco clyster is used, as I have already stated, in ileus (volvulus), strangulated hernia, obstinate constipation, retention of urine, &c. It is not to be forgotten that two drachms, one drachm, and even half a drachm of tobacco infused in water, have proved fatal, as I have before mentioned. The cautious practitioner, therefore, will not use more than 15 or 20 grains.

[The U. S. Pharm. directs Tobacco ʒi; Boiling Water Oj. Macerate for an hour in a covered vessel, and strain. This is intended to be used cautiously, only portions being administered at a time, in accordance with the above statements.]

2. VINUM TABACI, E. [U. S.]; *Wine of Tobacco*.—(Tobacco ʒiijss; Sherry Oij. Digest for seven days, strain, express strongly the residuum, and filter the liquors.) [The U. S. Pharm. directs Tobacco ʒj; Wine Oj. Digest for fourteen days and filter.]—Sedative and diuretic. Employed in dropsy, dysury, &c. Rarely used. Dose from m℥x to m℥l.

3. UNGUENTUM TABACI, Ph. United States; *Ointment of Tobacco*.—(Fresh Tobacco, cut in pieces, ʒj; Lard lbj. Boil the tobacco in the lard, over a gentle fire, until it becomes friable; then strain through linen.)—Employed as an application to irritable ulcers and skin diseases, especially tinea capitis; but its use requires great caution.

An ointment, prepared with twenty drops of the empyreumatic oil of tobacco and an ounce of simple ointment, has been applied with advantage, by American practitioners, to indolent tumours and ulcers; but like all other preparations of tobacco, when employed externally, must be used with great caution.¹

175. SOLANUM TUBEROSUM, Linn.—COMMON POTATO.

Sex. Syst. Pentandria, Monogynia.

(Herba; Tuber.)

HISTORY.—Pedro de Cieça, in his *Chronica del Peru*, published at Seville, in 1553, is the first writer who mentions potatoes. They probably first came into Europe from the neighbourhood of Quito to Spain. In 1586, they were brought to England from Virginia by the colonists sent out by Sir Walter Raleigh, in 1584.

BOTANY. *Gen. Char.*—*Calyx* 5—10-cleft. *Corolla* hypogynous, rotate or rarely campanulate; tube short; limb plaited, 5—10-, rarely 4—6-cleft. *Stamens* 5, rarely 4 or 6, inserted in the throat of the corolla, exserted; filaments very short; anthers equal or sometimes unequal, converging, dehiscing by two pores at the apex. *Ovary* 2-, rarely 3—4-celled; the placenta attached to the dissepiments, adnate, with numerous ovules. *Style* simple; *stigma* obtuse. *Berry* 2-, rarely 3—4-celled. *Seeds* numerous, subreniform. *Embryo* peripheral, spiral, inclosing fleshy albumen (Endlicher).

Sp. Char.—Tuberous. Stems herbaceous. Leaves interruptedly pinnate, downy; leaflets entire. Pedicels articulated. Flowers white.

Hab.—West coast of South America. Cultivated everywhere.

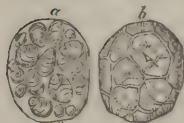
The cultivated varieties of the potato are very numerous. They are distinguished according to their precocity, lateness, form, size, colour, and quality.

DESCRIPTION.—1. The part of the plant which is used as food, is the *tuber*

¹ United States Dispensatory.

(*tuber solani tuberosi*) attached to the subterranean stem, of which, in fact, it may be regarded as a part in a state of excessive development. It is provided with a

Fig. 308.



Cells of the Potatoes.

a. Cell before boiling, containing the starch particles.

b. Cell of a mealy potato after boiling.

number of buds, commonly called *eyes*, which, with contiguous portions of the potatoes, are used, under the name of *sets*, for multiplying the species. The tubers vary in shape; being round, oblong, or kidney-shaped. When boiled, they vary in quality; being watery, waxy, or mealy. When examined by the microscope, the tissue of the potato is found to consist of a mass of cells, between and within which is an albuminous juice. Each cell also contains about ten or twelve starch grains¹ (Fig. 308, a). By boiling, the cells are separated, the starch grains absorb the albuminous liquid, swell up, and completely fill the cells; while the albumen coagulates and forms irregular fibres, which are placed between the starch grains (Fig. 308, b). Potatoes in which these changes are complete are called *mealy*, while those in which the liquid is only partially absorbed, and

the coagulation imperfectly effected, are denominated *doughy* or *watery*.² By boiling in water, potatoes do not form a jelly or mucilage like mere starch, because the starch grains in the tubers are protected partly by the coats of the cells in which they are contained, and partly by a layer of coagulated albumen.

2. For medicinal purposes the *herb* (*herba solani tuberosi*), including both stems and leaves, has been employed.

COMPOSITION.—Potatoes have been repeatedly subjected to chemical examination. The following are the results of analyses made by Michaelis³ and by Johnston.⁴

(Michaelis.)		Natural.	MEAN OF NUMEROUS ANALYSES MADE IN 1846.		
			(Johnston.)		
			Natural.	Dry.	
Water	.....	66.875	75.52	.....	—
Starch and amylaceous fibre	.....	30.469	15.72	.....	61.90
Albumen	.....	0.503	0.55	.....	2.25
Gluten	.....	0.055	3.30	.....	13.47
Fat	.....	0.056	1.41	.....	5.77
Gum	.....	0.020	0.24	.....	1.00
Asparagin	.....	0.063	3.26	.....	13.31
Extractive	.....	0.921			
Chloride of Potassium	.....	0.176			
Silicate, phosphate, and citrate of iron, manganese, alumina, soda, potash, and lime (of these potash and citric acid are the prevailing ingredients)	.....	0.815			
Free citric acid	.....	0.047			
Red variety of potato	.....	100.000		100.00	100.00

As a portion of both albumen and gluten adheres to the fibre, and of both, with some of the casein, to the starch, the true percentage of protein matters is somewhat understated in the above table; and Johnston, therefore, gives the following as the representation, in round numbers, of the composition of the dry potato: starch 64, sugar and gum 15, protein compounds 9, fat 1, and fibre 11.

The proportion of water, starch, and protein matters in the potato, according to the investigations of Horsford and Krockers,⁵ have been already given (see vol. i. p. 119.)

The ultimate composition of the potato, according to Boussingault,⁶ is as follows:—

Natural.		Dry.	
Water	75.9	Carbon	44.0
Solid matter, viz.:—		Hydrogen	5.2
Carbon	10.6940	Oxygen	44.7
Hydrogen	1.3978	Nitrogen	1.5
Oxygen	10.7727	Ashes	4.0
Nitrogen	0.3615		
Ashes	0.9640		
	100.0		100.0

¹ See Turpin's *Mémoire sur l'Organisation intérieure et extérieure des tubercles du Solanum tuberosum*, in the *Mémoires du Muséum d'Hist. Naturelle*, t. xix. Paris, 1830.

² Fritzsche, in Poggendorff's *Ann. d. Phys. u. Chem.* Bd. xxxii. S. 159; and *Pharm. Central-Blatt für 1834*, pp. 927 and 943.

³ *Archiv d. Pharm.* xiii. 233; and *Pharm. Central-Blatt für 1838*.

⁴ *Lectures on Agricultural Chemistry*, 2d edit. p. 906, 1847.

⁵ *Ann. der Chemie u. Pharm.* Bd. xlviii. 1846.

⁶ *Ann. de Chimie et Physique*.

Baup,¹ Spatzier,² and Otto,³ have found solanina in potatoes.

1. **SOLANINA**; *Solanine*; *Potato-Solanin*.—Found chiefly in the buds and shoots (sprouts) of the potato; also in the leaves, stalks, and fruits. Even sound ripe potatoes (the tubers) contain traces of it; but diseased potatoes, according to Liebig,⁴ do not yield it. (For the properties of *Solanina*, see *Solanum Dulcamara*.)

2. **STARCH** (see p. 501).

3. **PROTEIN COMPOUNDS**; *Albumen*, *Gluten*, and *Casein*.—The juice of the potato coagulates when heated, owing to the albumen which it contains. If the washings of a grated potato be heated to coagulate the albumen, and a little acetic acid be added to the strained liquor when cold, a white powder, called casein, is precipitated. If dry potato in powder be boiled in alcohol, the solution evaporated, and water added to it, a substance resembling the gluten of wheat is obtained. In potatoes which have been kept for some time, the proportion of protein matters is diminished.—In diseased potatoes, the protein compounds appear to be the constituents chiefly affected: the albumen is diminished in quantity, and altered in quality, becoming dark, especially on coagulating; while, according to Liebig, the casein is augmented in quantity.

4. **FAT**.—Ether extracts from dried sliced potatoes a minute portion of fatty matter.

5. **GUM** (*Dextrine*) and **SUGAR**.—Healthy potatoes contain small portions of that variety of gum called dextrine, and also of sugar. When the quantity of these ingredients is unusually large, as in diseased potatoes, the quantity of starch is proportionately small.

6. **CELLULOSE**; *Fibre*; *Lignin*.—The proportion of this constituent of the potato is subject to great variation. As usually obtained, it contains some adherent starch and protein matters: hence the nutritive qualities of the pulp of potato mills, which is used for feeding cattle.

7. **ACIDS AND SALTS**.—The vegetable acid which exists in potatoes, and which several chemists⁵ have declared to be citric acid, is, according to Ilisch,⁶ *malic acid*. He also detected *phosphoric* and *hydrochloric acids*. By the microscope, crystals of *oxalate of lime* can be detected.⁷

The quantity of ash obtained by drying and burning the potato, varies from 0.76 to 1.58 of the weight of the potato in the natural state. It consists, in large proportion, of *potash salts*, with some *soda* and *lime salts*. These bases are combined with carbonic acid (produced by the decomposition of the malic and oxalic acids), phosphoric acid, sulphuric acid (formed by the oxidation of the sulphur of the protein matters), and hydrochloric acid.

DISEASES OF THE POTATO.—The potato is subject to various diseases, the chief of which are the *curl*, the *scab*, and two sorts of *rot*—one called the *dry rot*, the other the *wet rot*. Martius⁸ mentions two other maladies also; namely, the *rust*, and the *blue pock*, but they are imperfectly known. The disease, called the *potato murrain*, or *potato blight*, which recently raged epidemically among the potatoes of Europe and America,⁹ was a kind of rot, usually of the humid or wet kind. The cause of this, as of the other maladies of the potato, is very obscure.¹⁰

The *scab* (*porrigo tuberum solani*) is characterized by the surfaces of the tubers becoming "covered with pustules, which at length become cup-shaped, and are powdered within with an olive-yellow meal, consisting of the spores of a fungus," which Martius calls *Protomyces Tuberum Solani*, but which Mr. Berkeley terms *Tubercinia Scabies* (Sub-order Hyphomycetes—see *ante*, p. 80).

In the *dry rot* (*gangrana sicca tuberum solani*) "the tubers, when stored for winter use, or when planted, become impregnated with a kind of mould, and are at length so hard that they can scarcely be broken, and, instead of producing shoots, merely throw out a few small misshapen tubers." In 1830, this disease was first noticed in Germany. Martius ascribes it to the growth of a peculiar fungus, the *Fusisporium Solani* (Sub-order Hyphomycetes—see *ante*, p. 80).

The *wet rot* (*gangrana humida tuberum solani*) differs from the preceding in the circumstance that the tubers become soft instead of hard; and parasitic fungi, referred by Fries to his genus

¹ *Ann. de Chimie*, 1826.

² Buchner's *Report*. Bd. xxxix. p. 490, 1831.

³ *Journ. für prakt. Chemie*, Bd. i. p. 58; and Buchner's *Report*. Bd. xlviii. p. 336, 1834.

⁴ *Pharmaceutical Journal*, vol. v. p. 263, 1845.

⁵ Baup (Buchner's *Report*. 2te Reihe, Bd. iii. p. 390, 1835) says that the potato yields sufficient citric acid to admit of its being employed for the preparation of this acid for commercial purposes. He also states that he found succinic acid and a new acid, which he calls *solano-tuberic acid*, in potatoes.

⁶ *Annal. der Chem. u. Pharm.* Bd. li. p. 246, 1844.

⁷ Johnston's *Lectures on Agricultural Chemistry*, 2d edit. p. 905, 1847.

⁸ *Die Kartoffel-Epidemie der letzten Jahre oder die Stockfaule und Räude der Kartoffeln, geschildert und in ihren unsäuerlichen Verhältnissen erläutert*, von Dr. C. Fr. Ph. v. Martius, München, 1842.

⁹ The first notice of the disease in England was by Dr. Bell Salter, in the *Gardener's Chronicle*, Aug. 16, 1845.

¹⁰ The fungal hypothesis of the potato blight has been ably advocated by Mr. Berkeley, in a paper entitled *Observations, Botanical and Physiological, on the Potato Murrain*, published in the *Journal of the Horticultural Society*, vol. i. p. 9, 1846. Most authors ascribe the disease to peculiar atmospheric or meteorological conditions. Mr. Smea (*The Potato Plant, its Uses and Properties, together with the Cause of the Present Malady*, 1846) attributes it to an animal parasite, the *Aphis vastator*—a species of hemipterous insect, which punctures the leaf, sucks the sap, and thus, by exhausting the plant, causes the death of the leaf or of some other part.

Periola (Sub-order Gasteromycetes—see *ante*, p. 88), appear, for the most part, under the form of hemispherical masses bursting through the cuticle.

The *potato murrain*, or *potato blight*, commonly called the *potato disease*, is closely allied to, if it be not identical with, the rot—usually, the wet rot. But, according to Mr. Berkeley, it is characterized by the presence of *Botrytis infestans* (Sub-order Hyphomycetes—see *ante*, p. 80). The malady commences in the leaves, and extends from thence by the stems to the tubers. Both on the inferior surface of the leaves and in the tubers a peculiar fungus has been discovered, called by Dr. Montagne the *Botrytis infestans*, which has been very fully described and figured by Mr. Berkeley.—The malady seems to affect chiefly the protein constituents of the potato. Liebig¹ states that a part of the vegetable albumen which usually prevails in the potato has become converted into casein. The starch appears to be unaltered in quality.

PHYSIOLOGICAL EFFECTS. 1. *Of the herb*.—An extract obtained from the stalks and leaves of potatoes was declared by Dr. J. Latham² to possess narcotic properties in doses of two or three grains, but the cases adduced are not satisfactory. Furthermore, his experiments were repeated by Dr. Worsham³ with very different results, for 100 grains produced no sensible effects. The observations of Nauche,⁴ however, tend to confirm Latham's statements.

2. *Of the tubers*.—Potatoes, when in good condition, and cooked by boiling, form a nutritious and easily digestible article of food. The starch, sugar, gum (dextrine), and fat, serve for the production of fatty matters, sugar, lactic acid, and, by combustion, of heat and carbonic acid. The protein matters (albumen, gluten, and casein) are plastic elements of nutrition, and serve for the production of fibrinous, albuminous, and gelatigenous tissues. According to Gunsford, the non-digestible constituents of the potato, and which he found in the excrements, are the cellular, fibrous, and vascular tissues, with which some undigested starch grains are intermixed.

Potatoes are valuable antiscorbutics. Sir G. Blane, Julia Fontanelle, Nauche, Dr. Baly, and others, have testified to their valuable preservative qualities against scurvy.⁵ These have been ascribed to the vegetable acids contained in the tubers, but Dr. Garrod (see vol. i. p. 461) attributes them to the presence of a large quantity of potash.

From an experiment made at the Glasgow Bridewell, it would appear that baked potatoes are less nourishing than boiled ones.

The process of cooking potatoes is useful in two ways; by effecting changes in the nutritive principles (*e. g.* rendering the starch digestible), and by extracting some noxious matter (solanina). The water in which potatoes are boiled possesses some noxious properties; Nauche found that it augmented the renal and biliary secretions, and slightly affected the nervous system.

USES. 1. *Of the herb*.—The extract has been used as a narcotic and antispasmodic to allay cough, spasm, rheumatic pains, &c. The dose is from one-eighth to half a grain.

2. *Of the tubers*.—Scraped potato is a popular application to burns and scalds. Boiled potatoes have been used for the formation of emollient poultices. They may be employed as an antidote in poisoning by iodine (see vol. i. pp. 202 and 405). For dietetical purposes potatoes are valuable antiscorbutics. In diabetes, however, they are objectionable on account of the large quantity of starch which they contain. But bread made of potato and cellulose (rasped potatoes deprived, by washing, of starch) has been employed as a *bread for diabetic patients*.⁶

Potatoes are used by bakers in the preparation of the ordinary loaf bread of London (see *ante*, p. 126).

¹ *Pharmaceutical Journal*, vol. v. p. 263, 1845.

² *Med. Trans.* vol. i. p. 92.

³ Nauche, *Journ. de Chim. Méd.* t. vii. p. 373.

⁴ *United States Dispensatory*.

⁵ See my *Treatise on Food and Diet*, 1843.

⁶ Percy, *Chemical Gazette*, vol. vii. p. 119, 1849.—The following is Mr. Palmer's receipt for making the bread:—Take the ligneous matter of 16 lbs. of potatoes washed free from starch, 4 lb. of mutton suet, 4 lb. of butter, 12 eggs, $\frac{1}{2}$ oz. of carbonate of soda, and 2 oz. of dilute hydrochloric acid. This quantity is divided into eight cakes, and in a quick oven baked until nicely browned. Care must be taken to procure pure hydrochloric acid, as some commercial sorts contain arsenic (see vol. i. p. 390).—This bread may be regarded as a substitute for the *bran bread* already described (see *ante*, p. 127).

1. *AMYLUM SOLANI TUBEROSI*; *Potato Starch*.—Obtained by washing potatoes, then rasping or grinding them to a pulp, and repeatedly washing the latter with water. The washings are strained through a sieve to separate the fibre or cellular tissue, and then allowed to stand at rest, by which the starch is deposited, and is afterwards washed and dried.

The quantity of starch yielded by potatoes varies with the variety or sort, the soil, the climate, and the season. Payen found the same variety of potato to yield, in October, 17.2 per cent. of starch; in November, 16.8; in December, 15.6; in January, 15.5; in February, 15.2, in March, 15.0; and in April, 14.5. In general, the centre of the potato yields the smallest portion, the heel end which is attached to the rootlet the most, and the rose or upper end an intermediate portion of starch.

Potato starch is white and pulverulent, and, on account of the large size of its particles,¹ has a satiny or glistening character. The smaller grains are circular or globular; the larger ones elliptical, oblong, ovate, or obtusely triangular. Frequently, their shape is irregular, and approximates to that of an oyster-shell, or a mussel-shell. Their nucleus, central cavity, or hilum, is very distinct; and their laminated structure is indicated by a system of concentric or excentric rings or zones surrounding the nucleus. It is most allied in appearance to the starches of Marantaceæ. The characters by which they are distinguished from West Indian arrowroot, and from *tous-les-mois*, have been before pointed out (see *ante*, pp. 226 and 228). The mode of distinguishing potato starch from wheat starch has likewise been stated (see *ante*, p. 125).

In its general chemical properties it agrees with other starchy bodies. In cold water it is insoluble. If 1 part of potato starch be mixed with 15 parts of water, and heated, the liquid begins to be thick and mucilaginous at about 140° F.; and as the heat augments, especially from 162° F. to 212° F., it acquires a pasty or gelatinous consistence. Starch-paste or starch-mucilage is not, however, a true solution of starch in water; the starch grains are burst and exfoliated, the coats or laminae being hydrated and enormously swollen. In cold water, to which a small quantity of caustic potash or soda has been added, they become enormously swollen (see *ante*, p. 125). Starch-mucilage in the cold becomes intensely blue on the addition of iodine; the colour is destroyed by heat or caustic alkalies.

The greater facility with which potato starch gelatinizes when rubbed in a mortar with a mixture of equal parts of commercial hydrochloric acid and water;² the strong smell of formic acid emitted when it is rubbed with hydrochloric acid; the dove-gray colour which it assumes when exposed to the vapour of iodine;³ and the transparency of the mucilage which it forms with boiling water (whence it has been termed *soluble starch*), are characters by which it has been attempted to distinguish potato starch from other sorts of starch, but with no great success, as they are not to be relied on.

Potato starch, in the pure or anhydrous state, consists of $C^{12}H^{10}O^9$; but, as found in commerce, it contains water.

COMPOSITION OF POTATO STARCH.

Anhydrous starch (as combined with oxide of lead)	=	$C^{12}H^{10}O^9$
Starch dried in a vacuum at from 212° to 284° F.	=	$C^{12}H^{10}O^8, HO$
Starch dried in a vacuum at 68° F.	=	$C^{12}H^{10}O^8, 3HO$
Starch air-dried at 68° F. (hydr. 0.6)	=	$C^{12}H^{10}O^8, 5HO$
Starch dried in air saturated with humidity	=	$C^{12}H^{10}O^8, 11HO$
Starch drained as much as possible	=	$C^{12}H^{10}O^8, 16HO$

¹ The following measurements, in parts of an English inch, of ten particles of potato starch, were made for me by Mr. George Jackson:—

	Length.	Breadth.		Length.	Breadth.
1.	0.0023	× 0.0016	6.	0.0007	× 0.0006
2.	0.0021	× 0.0014	7.	0.0005	× 0.0005
3.	0.0018	× 0.0013	8.	0.0004	× 0.0004
4.	0.0011	× 0.0009	9.	0.0003	× 0.0003
5.	0.0009	× 0.0007	10.	0.0002	× 0.0002

² Schelling, *Pharmaceutical Journal*, vol. ii. p. 447, 1842.

³ Gobley, *Journ. d. Pharm.* ser. 3me, t. v. p. 299, 1844.

Potato starch is sometimes adulterated. M. Dietrich¹ mentions having received some which was adulterated to the extent of 50 per cent. with comminuted fibre, and which prevented the employment of the starch in the fabrication of yeast for a distillery.

Potato starch possesses the alimentary properties of other starchy substances, and which have been before noticed (see vol. i. p. 119, and *ante*, 107). It does not, however, yield so firm a jelly as some other starches, and has been said to be apt to occasion acidity, especially in infants. It is sold under the various names of *potato flour*, *English arrowroot*, *Bright's nutritious farina*, &c.; and is used as a farinaceous food for infants and invalids, as well as for the preparation of puddings and soufflés, and, as a thickening ingredient, in gravies, sauces, &c.

Potato starch is used in the production of a factitious sago (see *ante*, p. 166), in the preparation of dextrine, and in the manufacture of *potato sugar* (see *ante*, p. 151).

2. DEXTRINA; *Dextrine*; *Dextrinum*; *Starch-Gum*. Formula $C^{12}H^{10}O_5$. 110. This substance is called "dextrine," from its property of rotating to the right a ray of plane polarized light. There are three modes of procuring it from starch; viz., by torrefaction, by the action of dilute acids (usually nitric acid), and by the action of diastase. The impure dextrine obtained by torrefying or roasting starch is termed *roasted starch* or *leicomme* (from *λεῖος*, smooth; and *gomme*, the French name for gum!). This sort of dextrine resembles British gum (see *ante*, p. 125), is pulverulent, and has the aspect of starch, but it usually possesses a yellowish tint in consequence of being over-roasted. A second method consists in moistening 1000 parts of potato starch with 300 parts of water, to which 2 parts of nitric acid have been added. The mixture is to be allowed to dry spontaneously, and is afterwards heated, for one or two hours, in a stove at 212° F. or 230° F.; the transformation is then complete.

Dextrine is soluble in water and in dilute spirit, but is insoluble in alcohol. Its solution is perfectly limpid; and, by concentration and solidification, it is obtained in an amorphous form like gum arabic. It is sometimes made up in tear-like masses in imitation of gum arabic, and in this state is called *artificial gum*. This, when fresh, has an odour like that of a cucumber; but, by keeping, I find that it loses this smell. The solution of dextrine yields, with acetate of lead, a precipitate (*dextrinate of lead*). As usually found in the shops, the solution strikes a violet or reddish tint with iodine; but in this case the starch has been incompletely converted into dextrine, which, when pure, is not coloured by iodine.

Dextrine in many of its characters resembles ordinary gum; from which, however, it is distinguished by its right-handed rotation of a ray of plane polarized light, and by its yielding oxalic acid, but not mucic acid, when heated with nitric acid. Saccharine matter, when mixed with dextrine, may be separated by strong spirit, which more readily dissolves sugar than dextrine. The freedom of dextrine from starch is readily shown by the iodine test.

Dextrine is used in the arts as a substitute for gum, size, and paste. The saccharine solution of dextrine obtained by the action of diastase (contained in the infusion of malt) on potato starch is used in Paris in the manufacture of *pains de luxe*, and for the fabrication of beer and other alcoholic liquors. In medicine, dextrine is employed as a nutrient, as an emollient, and as an agglutinant. In the French hospitals it is used in *tisanes* as a substitute for gum. Devergie has employed it with benefit in the treatment of eczema. Velpeau has employed dextrine as a substitute for gum arabic or starch, in the preparation of bandages for maintaining the reduction of fractures by what is called "the immovable apparatus." For this purpose, 100 parts of dextrine are moistened first with a small quantity of

¹ *Chemical Gazette*, vol. ii. p. 20, 1844.

spirit of camphor, and then mixed with 40 parts of water. The bandages are soaked in the thick mucilage thus obtained.¹

176. SOLANUM DULCAMARA, Linn.—WOODY NIGHT-SHADE; BITTERSWEET.

Sex. Syst. Pentandria, Monogynia.
(*Ramus novellus*, L.—*Twigs*, E. D. U. S.)

HISTORY.—Fraas² declares this plant to be the *σπύγνος ἰππωτικός* of Dioscorides (lib. iv. cap. 73). Sprengel³ considers it to be the *Citocatia* of the Abbess Hildegard, of Bingen, who died A. D. 1180. But the derivation of the word *Citocatia* (*cito* and *cacare*) negatives, in my opinion, this supposition. The first undoubted notice of *Dulcamara* occurs in the work of Tragus.⁴

BOTANY. *Gen. Char.*—See *ante*, p. 497.

Sp. Char.—Stem shrubby, zigzag. Leaves cordate-ovate; upper ones auriculate-hastate. Flowers drooping (Babington).

Root woody. *Stem* twining, branched, rising (when supported) to the height of many feet. *Leaves* acute, generally smooth; the lower ones ovate or heart-shaped; upper, more or less perfectly halbert-shaped; all entire at the margin. *Clusters* either opposite to the leaves or terminal, drooping, spreading, smooth, alternately subdivided. *Bracts* minute. *Flowers* elegant, purple, with two round green spots at the base of each segment. *Berries* oval, scarlet, juicy.

Hab.—Indigenous. In hedges and thickets, especially in watery situations. Flowers in June and July.

Var. *β tomentosum*, Koch.—Stem round, almost glabrous throughout.—Woods and hedges; common.

Var. *γ murinum*, Babington; *S. lignosum* seu *Dulcamara marina*, Ray.—Branches of the present year, and leaves fleshy and usually clothed with hairs incurved upwards. Stem angular, prostrate, diffuse, much branched. Leaves all (?) cordate, not hastate.—Pebbly sea-beach. Renville, Cunnamara, Galway; Lizard Point, Cornwall; Shoreham, Sussex (glabrous).

DESCRIPTION.—The annual stems (*caules* seu *stipites dulcamaræ*) are collected in the autumn, after the leaves have fallen.

It is to be gathered in autumn when destitute of leaves.—*Ph. Lond.*

When fresh, they have an unpleasant odour, which they lose by drying. Their taste is at first bitter, afterwards slightly acid and sweet. The epidermis is greenish-gray, the wood light, and the pith very light and spongy.

COMPOSITION.—The stems have been analyzed by Pfaff.⁵ 100 parts of the air-dried stems lost 17.4 parts of water when completely dried. From 100 parts of perfectly dried stems Pfaff obtained *bittersweet extractive* (*picroglycion*) 21.817, *vegeto-animal matter* 3.125, *gummy extractive* 12.029, *gluten with green wax* 1.4, *resin containing benzoic acid* 2.74, *gummy extractive, starch, sulphate and vegetable salts of lime* 2.0, *oxalate and phosphate of lime with extractive* 4.0, and *woody fibre* 62.0 (excess 9.111). Desfosses⁶ discovered *solanina* in the stems.

1. **DULCAMARIN**; *Picroglycion*, Pfaff; *Dulcarin*, Desfosses.—Crystalline; has both a bitter and a sweet taste, is fusible, soluble in water, alcohol, and acetic ether, and is not precipitated from its solution by either infusion of nutgalls or metallic salts.⁷ Pelletier⁸ thinks that it is sugar combined with *solanina*.

+

2. **SOLANINA**; *Solanin*; *Solanine*. Symbol So. Formula $C^{64}H^{68}NO^{23}$. Eq. Weight 810?—This alkaloid has been discovered in several species of *Solanum*; viz. *S. Dulcamara*, *S. tuberosum*, *S. nigrum*, and *S. verbascifolium*. It resembles sulphate of quinia, but its needle-like crystals are finer and shorter. It restores the blue colour of litmus paper reddened by an acid. It dissolves

¹ Mr. Smee (*London Medical Gazette*, N. S. vol. i. Feb. 23, 1839), in his paper, "On the Formation of Moulding Tablets for Fractures," says, that "a mixture of carbonate of lime with the solution of dextrine made a composition which answered very well," but it was not equal to a composition of gum and whitening.

² *Synopsis Plant. Fl. Classicæ*, p. 168, 1845.

³ Sprengel, *op. cit.* p. 319.

⁴ *Journ. de Pharm.* t. v. ii. p. 411.

⁵ Soubeiran, *Traité de Pharm.* t. ii. p. 52.

⁶ *Hist. Rei Herb.* vol. i. p. 227.

⁷ *Syst. de Mat. Med.* Bd. vi. S. 506.

⁸ *Journ. de Pharm.* vii. 416.

in acids, and is precipitated from its solution by the caustic alkalies. Some of the salts (as the acetate and hydrochlorate) have a gummy appearance when evaporated to dryness; others (as the phosphate and sulphate) are crystallizable. Iodine strikes a characteristic turbid brown colour with a solution of solanina or of its salts, owing to the formation of the insoluble brown iodide of solanina¹. If Blanchet's analysis be correct, solanina differs from the other vegetable alkalies in the small quantity of nitrogen which it contains, and in its very high atomic weight. A grain of solanina, dissolved in dilute sulphuric acid, killed a rabbit in six hours; four grains of the sulphate caused, in an hour, paralysis of the hind legs; and, in eight hours, death². Soubeiran says it does not dilate the pupils like the other alkalies of Solanaceæ.

CHEMICAL PROPERTIES.—A strong decoction of dulcamara is slightly darkened by tincture of iodine. Iodic acid had no effect on it. Iodide of potassium rendered it feebly yellow. Tincture of galls had no effect.

PHYSIOLOGICAL EFFECTS.—Not very obvious. Its decoction operates as a diaphoretic and diuretic. It is said also to promote secretion from the mucous surfaces, and to diminish sensibility. In excessive doses, dulcamara is stated to have acted as an acro-narcotic.³ Chevallier⁴ says a young man experienced narcotism from carrying a bundle of the plant on his head. But the accuracy of all these observations has been called in question by Jos. Frank,⁵ by Dunal, and by Fages.⁶ The first gave the decoction, the latter the extract and fruit, in very large doses, without any obvious effects.

USES.—Dulcamara has been thought serviceable in chronic pulmonary catarrhs, in rheumatic and gouty complaints, in chronic skin diseases, and in various cachectic conditions of the system, in which sarsaparilla has been found beneficial. As a remedy for lepra, it was introduced to the notice of British practitioners by Dr. Crichton. For this disease, it has been declared a most effectual remedy by Bate-man;⁷ while Rayer⁸ speaks of its good effects in eczema and psoriasis. In the few cases in which I have tried it, it proved useless.

DECOCTUM DULCAMARÆ, L. E. D. [U. S.]; *Decoction of Bittersweet.*—(Dulcamara, sliced [chopped down, *E.*], ʒx [ʒj, *E.* [U. S.]; ʒss, *D.*]; Water [Distilled, *L.*] Oj [fʒxxiv, *E.*; Oss, *D.*; Ojss, *U. S.*]. Boil [down to a pint, *L. E.*; for ten minutes, *D.*] and strain.)—Diaphoretic and diuretic. The usual dose stated in books is fʒss to fʒj. But I have given fʒiv for a dose. Rayer has given four ounces of the root in decoction in twenty-four hours.

177. *Solanum nigrum*, Linn.—Black Nightshade.

Sez. Syst. Pentandria, Monogynia.
(Herba.)

Στεφύλιος κηπάριος, Dioscorides (lib. iv. cap. 71); *Common or Garden Nightshade*.—Stem herbaceous, with tubercled angles; a foot or more high. Leaves ovate, obtusely dentate or wavy, attenuated below. Flowers lateral, drooping, sometimes with a musky scent; corolla white. Berries globular, black, or rarely green when ripe. Indigenous; waste grounds. No complete analysis of it has been made. Desfosses⁹ has found malate of solanina in the fruit. Black nightshade possesses narcotic properties, but its powers appear to be neither great nor uniform. Its emanations are said to be soporific; and in Bohemia, a handful of the fresh plant is sometimes placed in the cradles of infants to promote sleep.¹⁰ In England, this plant has been employed as a resolvent.¹¹ Smith¹² says, a grain or two of the dried leaf has sometimes been given to promote various secretions, possibly, he adds, by exciting a great and rather dangerous agitation in the viscera.

¹ Baumann, *Pharmaceutical Journal*, vol. iii. p. 354, 1841.

² Otto, *Pharm. Central-Blatt. für 1834*, p. 455.

³ Murray, *App. Med. t. i. p. 60*; and Schlegel, *Hufeland's Journal*, Bd. liv. St. 2, S. 27.

⁴ *Dict. des Drog. t. ii. p. 228.*

⁵ Orfila, *Toxicol. Gén.*

⁶ *Treatise on Diseases of the Skin*, by Dr. Willis, p. 91.

⁷ *Journal de Pharm. t. vii. p. 414, 1821.*

⁸ Weitenweber, quoted by Dierbach, *Die neueste Entdeck. in d. Mat. Med. Bd. ii. p. 907, 1843.*

⁹ Gataker, *Obs. on the Use of Solanum*, 1757; Bromfield, *Account of the Engl. Nightshades*, 1757.

¹⁰ *English Flora*, vol. i. p. 318, 1824.

¹¹ *Handb. d. Toxicol. S. 61, 1803.*

¹² *Synopsis of Cutaneous Diseases.*

178. *CAPSICUM ANNUUM*, Linn.—et *C. FASTIGIATUM*, Blume.

Sez. Syst. Pentandria, Monogynia.

(Capsicum Fastigiatum, *Bl.*—Fructus, *L.*—Fruit of Capsicum annuum and other species; Capsicum or Chillies, *E.*—Capsicum annuum; the fruit, *D.*)

HISTORY.—The *piperitis* or *siliquastrum* of Pliny,¹ is declared by Sprengel² to be undoubtedly Capsicum annuum. But confidence in this opinion is greatly diminished by the doubt entertained as to this plant being a native of Asia.³ Of course, if it be exclusively a native of America, there is no reason for supposing that Pliny could have been acquainted with it. Fraas⁴ considers it to have been Capsicum longum, DC., which Theophrastus⁵ terms *πίπερι ἀπόμηχες*. The term capsicum (*κάψικον*) occurs first in Johannes Actuarius.

BOTANY. **Gen. Char.**—*Calyx* 5—6-cleft. *Corolla* hypogynous, rotate; tube very short; limb plaited, 5—6-cleft. *Stamens* 5—6, inserted in the throat of the corolla, exserted; filaments very short; anthers connivent, dehiscing longitudinally. *Ovary* 2-, 3-, 4-celled; the placentæ adnate to the base of the dissepiment or central angle. *Style* simple, subclavate; *stigma* obtuse, obsoletely 2—3-lobed. *Berry* juiceless, polymorphous, incompletely 2—3-celled, placentæ and septa deliquescent superiorly. *Seeds* many, reniform; embryo within fleshy albumen, peripheral, hemicyclical (Endlicher).

1. *C. ANNUUM*, Linn. *Common Capsicum* or *Chilly Pepper*.—Fruit oblong, pendulous, and erect. Petioles glabrous. Stem herbaceous. Calyx obsoletely 5-toothed.

Herbaceous annual, 1 to 2 feet high. *Leaves* ovate or oblong, acuminate, long-stalked, almost entire, sometimes hairy on the veins underneath. *Flowers* white. *Berry* scarlet, yellow, variegated with red and yellow, or dark green; variable in shape, being oblong, round, or cordate.

America. A doubtful native of the East Indies. Cultivated in England.

2. *CAPSICUM FASTIGIATUM*, Blume, Bijdr. 705, L.; *C. frutescens*, Linn. Sp. Pl. but not Hist. Cliff. Frutescent; branches tetragonal, fastigiate, diverging, pubescently scabrous; fructiferous calyx, subcylindrically truncate; fructiferous peduncles, generally twin, erect; berry, oblong-cylindrical, straight; leaves oval or lanceolate, acuminate at both ends, minutely and serrulately ciliated.—India. Shrub 1 or 2 feet high.

DESCRIPTION.—1. The dried fruit, sold by druggists as *chillies* (*fructus vel baccæ capsici annui*), is flat, more or less shrivelled, oblong, blunt or pointed at one end, while the calyx or stalk is usually attached at the other end. The length of the berry (independent of the stalk) is two or three inches, the breadth one-half to three-quarters of an inch, the colour yellowish or reddish-brown, the taste hot and pungent, the odour none. The epidermis is tough and leathery; the seeds are flattened and whitish. The recent fruit, called *capsicum* or *chillies*, grown in this country, and sold for pickling, is, when ripe, yellow or red, but it is frequently gathered green; its size and shape are variable, and it is distinguished as long-podded, short-podded, and heart-shaped.

2. The capsules sold by druggists as *Guinea pepper* (*Capsicum Guineense*, L.) or *bird pepper* (*baccæ capsici*) do not exceed an inch in length, and are about two or three lines broad; their colour is orange-red, their odour aromatic and pungent. Their properties are similar to those of chillies, than which they are much hotter and more fiery. Their powder is *Cayenne pepper*, so extensively employed as a condiment. On comparing these fruits with those of *C. frutescens*, Linn., in the East Indian Solanaceæ belonging to the Linnæan Society, they appeared to me to be identical. But in the *London Pharmacopœia*, 1851, they are referred to *C. fasti-*

¹ Hist. Nat. lib. xix. cap. 62; and lib. xx. cap. 66, ed. Valp.² Roxburgh, Fl. Ind. vol. i. p. 573; Royle, Illustr. p. 27.³ Synops. Plant. Fl. Cl. p. 169, 1845.⁴ Hist. Rei Herb. vol. i. p. 201.⁵ Hist. Plant. lib. ix. cap. 22.

giatum, Blume, which is identical with one of the plants described by Linnaeus as *C. frutescens*. It deserves notice, however, that the commercial fruit is brought from Western Africa, where *C. fastigiatum* has not hitherto been found. In the *Niger Flora*, Sir W. Hooker gives *C. frutescens*, Var. and Linn. Sp. Pl. p. 271, as having been found by Vogel on the Island of St. Antonio.

Besides the above, several other species of *Capsicum* are employed dietetically and medicinally.

Oblong-cylindrical, straight, less than an inch in length.—*Pharm. Lond.*

CAPSICUM CERASIFORME, Wild.—The fruit of this species is called *cherry chilly* or *cherry pepper*. It is small, round, and cherry-shaped.

CAPSICUM GROSSUM, Linn.; *Bell Pepper*.—Fruit large, oblong or ovate, red or yellow.

COMPOSITION.—The fruit was analyzed, in 1816, by Maurach,¹ in the same year by Bucholz,² and in the following year by Braconnot.³

<i>Bucholz's Analysis.</i>		<i>Braconnot's Analysis.</i>	
Acrid soft resin (<i>capsicin</i>)	4.0	Acrid oil	1.9
Wax	7.6	Wax with red colouring matter	0.9
Bitter aromatic extractive	8.6	Brownish starchy matter	9.0
Extractive with some gum	21.0	Peculiar gum	6.0
Gum	9.2	Animalized matter	5.0
Albuminous matter	3.2	Woody fibre	67.8
Woody fibre	28.0	Salts (citrate of potash 6.0, phosphate of potash and chloride of potassium 3.4)	9.1
Water	12.0		
Loss	6.4		
Fruit of <i>Capsicum annum</i> without seeds	100.0	Fruit of <i>Capsicum annum</i>	100.0

CAPSIDIN, Bucholz; *Acrid Soft Resin*; *Acrid Oil*, Braconnot.—Obtained by digesting the alcoholic extract in ether, and evaporating the ethereal solution. It is a thick liquid, of a yellowish red or reddish-brown colour, which becomes very fluid when heated, and, at a higher temperature, is dissipated in fumes. Half a grain of it, volatilized in a large room, causes all who respire the air of the room to cough and sneeze. By exposure to air and light it solidifies. It is decolorized by chlorine. It is slightly soluble in water and in vinegar; but very much so in alcohol, ether, oil of turpentine, and the caustic alkalies. With baryta it forms a solid acrid combination.

PHYSIOLOGICAL EFFECTS.—*Capsicum* belongs to the spices (see vol. i. p. 253), and is more closely allied, by its effects, to the peppers (see *ante*, p. 351) than to any other article of the *Materia Medica*. Sundelin,⁴ however, considers it to be more related to pyrethrum. Its active principle is more fixed, and its operation is more permanent and violent, than mustard or horseradish.

Its hot and fiery taste is familiar to every one. Applied to the skin, *capsicum* proves rubefacient and vesicant. Swallowed in small doses, it creates a sensation of warmth in the stomach; and in torpid and languid habits proves a valuable stimulant, and a promoter of the digestive functions. Taken in somewhat larger quantities, it produces a glow over the body, excites thirst, and quickens the pulse; the latter effect, however, is not in proportion to its local effect. Like the peppers, it is said to exercise a stimulant influence over the urino-genital organs. In excessive doses we can easily believe that vomiting, purging, abdominal pain, and gastric inflammation, ascribed to it by Vogt,⁵ may be induced by it, though I am not acquainted with any cases in which these effects have occurred. Richter⁶ mentions, in addition to the symptoms just mentioned, a paralyzed and altered condition of the nervous influence, an affection of the head, drunkenness, and giddiness, as being produced by large doses.

USES.—*Capsicum* is more employed as a condiment than as a medicine. It is added to various articles of food, either to improve their flavour, or, if difficult of digestion, to promote their assimilation, and to prevent flatulence. The inhabitants of tropical climates employ it to stimulate the digestive organs, and thereby to counteract the relaxing and enervating influence of external heat.

As a medicine, it is principally valuable as a local stimulant to the mouth, throat,

¹ *Berl. Jahrb.* Bd. xvii. S. 63.

² *Ann. de Chim. Phys.* vi. 122.

³ *Pharmakodyn.* Bd. ii. S. 581, 2te Aufl.

⁴ *Gmelin, Handb. d. Chem.* ii. 1310.

⁵ *Handb. d. sp. Heilm.* Bd. ii. S. 44, 3te Aufl.

⁶ *Ausf. Arzneih.* Bd. ii. S. 179.

and stomach. Its constitutional not being in proportion to its topical effects, it is of little value as a general or diffusible stimulant. Administered internally, capsicum has long been esteemed in cases of *cynanche maligna*. It was used, in 1786, with great success by Mr. Stephens¹ and by Mr. Collins.² It promoted the separation of the sloughs, and soon improved the constitutional symptoms. Mr. Headby³ also employed it both internally and by way of gargle. Its use has been extended to *scarlatina anginosa*.⁴ As a gargle, in relaxed conditions of the throat, its efficacy is undoubted. The powder or tincture may be applied, by means of a camel-hair pencil, to a relaxed uvula. It is a very useful gastric stimulant in enfeebled, languid, and torpid conditions of the stomach. Thus in the dyspepsia of drunkards, as well as of gouty subjects, it has been found useful.⁵ In various diseases attended with diminished susceptibility of stomach, capsicum is an exceedingly useful adjunct to other powerful remedies, the operation of which it promotes by raising the dormant sensibility of this viscus; as in cholera, intermittents, low forms of fever, dropsies, &c. Dr. Wright⁶ speaks in high terms of it as a remedy for obviating the black vomit—a symptom of the fever of tropical climates, at one time considered fatal. A capsicum cataplasm may be used with advantage to occasion rubefaction in any cases in which a rubefacient counter-irritant is indicated; as in the coma and delirium of fever, in chronic rheumatism, &c.; unless kept on for a long period it does not vesicate.

ADMINISTRATION.—The *powder* of capsicum is usually given in doses of from gr. v to gr. x, made into pills with crumbs of bread. The dose of the *tincture* will be mentioned presently. The *infusion* (prepared by digesting ℥ij of capsicum in f℥x of boiling water for two hours) may be administered in doses of f℥ss. But, in malignant sore-throat and scarlatina, capsicum has been employed in much larger doses. *Stephen's pepper medicine* consisted of two table-spoonfuls of small red pepper, or three of the common Cayenne pepper, and two teaspoonfuls of fine salt, digested in half a pint of boiling water. To the liquor, strained when cold, half a pint of very sharp vinegar is added. A table-spoonful of this mixture to be given to an adult every half hour. The *capsicum gargle* is prepared by infusing ℥ss of capsicum in a pint of boiling water; or by adding f℥vj of the tincture to f℥viij of the infusion of roses; or, in some cases, Stephen's pepper medicine may be used as a gargle.

TINCTURA CAPSICI, L. E. D. [U. S.]; *Tincture of Capsicum*.—(Capsicum, bruised [or, if percolation be followed, in moderately fine powder, *E.*], ℥x [℥iss, *D.*]; Proof Spirit Oij [Oj, *D.*]. Digest for seven [fourteen, *D.*] days, then express and strain [strain, squeeze the residuum, and filter the liquors. [The *U. S. Pharm.* directs Capsicum, in powder, ℥i; Diluted Alcohol Oij.] This tincture is best prepared by percolation, which may be commenced so soon as the capsicum is made into a pulp with a little of the spirit, *E.*].—Dose ℥x to f℥j. Employed in the low stage of typhus and scarlet fevers, and in gangrenous sore-throat, and to prevent the nausea which oil of turpentine is apt to occasion. Properly diluted, it may be used as a gargle, as above mentioned. Externally, it is sometimes used as a local stimulant.

179. *Mandragora Officinarum*, Linn.—Common Mandrake.

Sex. Syst. Pentandria Monogynia.
(Radix.)

Μανδραγόρας ρίζας, ἀντίμυλον κερκία, &c., Dioscorides, lib. iv. cap. 76; *Mandragora*, Pliny, Hist. Nat. lib. xxv. cap. 94, ed. Valp.; *Atropa Mandragora*, Linn.—South of Europe. Mandrake is an acro-narcotic poison; when swallowed, it purges violently.⁷ The roots, from their fancied

¹ Duncan's *Med. Comment.* vol. ii. Dec. 2, 1788.

² *London Med. and Phys. Journ.* vol. v. p. 425, 1801.

³ Krieszig, *U. d. Scharlachfieber*, 1803, in Voigtel's *Arzneim.*

⁴ Chapman's *Elem. of Therap.* vol. ii.

⁵ Brandt and Ratzburg, *Deutsch. phan. Giftgewächse*, S. 79.

⁶ *Med. Communications*, vol. ii. p. 372, 1790.

⁷ *Med. Facts and Observ.* vol. vii.

resemblance to the human form, were called *anthropomorphon*, and were supposed to prevent barrenness.¹ The root of *Bryonia dioica* is sold at the herb-shops as a substitute for Mandrake. Dr. Sylvester² has recently drawn attention to the ancient uses of this plant as an anæsthetic.

ORDER XLIII. BORAGINACEÆ, Lindley.—BORAGEWORKS.

BORAGÆÆ, DC.—BORAGINÆÆ, Endl.

CHARACTERS—*Calyx* persistent, with 4 or 5 divisions. *Corolla* hypogynous, monopetalous, generally regular, 5-cleft, sometimes 4-cleft, with an imbricated æstivation. *Stamens* inserted upon the corolla, equal to the number of its lobes, and alternate with them. *Ovary* 4-parted, 4-seeded, or 2-parted, 4-celled; ovules attached to the lowest point of the cavity, amphitropal. *Style* simple, arising from the base of the lobes of the ovary; *stigma* simple or bifid. *Nect.* 2 or 4, distinct. *Seed* separable from the pericarp, destitute of albumen; embryo with a superior radicle; cotyledons parallel with the axis, plano-convex, sometimes 4 (!) in *Amsinckia*.—*Herbaceous* plants or *shrubs*. *Stems* round. *Leaves* alternate, often covered with asperities consisting of hairs proceeding from an indurated enlarged base. *Flowers* in 1-sided gyrate spikes or racemes, or panicles, some solitary and axillary (Lindley).

PROPERTIES.—The plants of this order are characterized by their mucilaginous quality; they are, therefore, mostly harmless and inert.

Formerly, several borageworts were used in medicine; for example, *Symphytum officinale*, Linn., *Borago officinalis*, Linn., *Cynoglossum officinale*, Linn., *Pulmonaria officinalis*, Linn., *Lithospermum officinale*, Linn., and *Echium vulgare*, Linn. They possess little medicinal value (though formerly many virtues were ascribed to them), and are now obsolete. The only boragewort still found in pharmacutists' shops is *Alkanna tinctoria*, Linn.

180. *Alkanna tinctoria*, Tausch.—Dyer's Alkanet.

Sex. Syst. Pentandria, Monogynia.

(Radix.)

* *Άλκυσα*, Dioscorides, lib. iv. cap. 23; *Lithospermum tinctorium*, Linn., *Herb. Sp. ed. i.* non ed. ii.; *Anchusa tinctoria*,³ Desf., *Atl. i.* p. 156; Hayne, *Arzneigew.*, 10, t. ii.; *Alkanna tinctoria*, Nees, *Off. Pflanz.*, Suppl. ii. t. 6; *Handb.* ii. 591; *Alkanna tinctoria*, Tausch, in *Flora*, 1844. A deciduous herbaceous plant with a perennial, dark blood-red root. This, when dried, constitutes the *alkanet root* (*radix alkannæ tinctoriæ*) of the shops, and which is sometimes called *spurious alkanet root* (*radix alkannæ spuria*) to distinguish it from the *henna* or *al-henna* of the Arabs (*Lawsonia alba*, Lam.), whose root is called the *true alkanet* (*radix alkannæ vera*). The plant grows on the shores of the Mediterranean, in Asia Minor, Greece, &c.

Alkanet root was analyzed by John,⁴ who found the constituents to be a *peculiar colouring matter* (pseudo-alkannin) 5.50, *extractive* 1.00, *gum* 6.25, *matters extracted by caustic potash* 65.00, *wooly fibre* 18.00=95.75 [loss 4.25]. The colouring matter resides in the cortical part of the root, and was regarded by Pelletier⁵ as a kind of fatty acid (*anchusic acid*); but it is now usually considered to be a resinoid (*anchusine*) whose composition is $C^{35}H^{20}O^8$. It is of a dark red colour, fusible at $140^{\circ} F.$, insoluble in water, but very soluble in alcohol and in acetic acid. The alkalis colour it blue. Acetate and subacetate of lead, protochloride of tin, the salts of iron and alumina, precipitate it; chlorine and strong acids destroy it. Alkanet root communicates its colouring matter to oily and fatty substances; and hence is used by the pharmacist to colour *lip salve* (*unguentum labiale*), *hair oil*, &c.

ORDER XLIV. CONVULVULACEÆ, R. Brown.—BIND-WEEDS.

CONVOLVULI, Jussieu.

CHARACTERS—*Calyx* persistent, in 5 divisions, remarkably imbricated, as if in more whorls than 1, often very unequal. *Corolla* monopetalous, hypogynous, regular, deciduous; the limb 5 lobed, plaited; the tube without scales. *Stamens* 5, inserted into the base of the corolla, and

¹ Matthioli, *Comm. Dioscor.*

² *Pharmaceutical Journal*, vol. vii. p. 516, 1845.

³ Smith (*Prodr. Fl. Græc.*, i. 116) and Gussone (*Syn.* p. 218) declare the *Anchusa tinctoria*, Linn., *Herb. Sp. ed. ii.* p. 192 (*Alkanna controversa*, DC., *Prodr.* x. 103, to be entirely different from the *Alkanna tinctoria*, Tausch.

⁴ *Chemische Schriften*, iv. 85; Kunze, *Waarenkunde*, ii. 37.

⁵ *Bull. de Pharm.* vi. 445, 1841; *Journ. de Pharm.* xix. 105, 1833.

alternate with its segments. *Ovary* simple, with 2 or 4 cells, seldom with 1; sometimes in 2 or 4 distinct divisions; few-seeded; the ovules definite and erect, when more than 1 collateral; *style* 1; usually divided at the top, or as many as the divisions of the ovary, and arising from their base; *stigma*s obtuse or acute. *Disk* annular, hypogynous. *Capsule* with from 1 to 4 cells, succulent or capsular; the valves fitting, at their edges, to the angles of a loose dissepiment, bearing the seeds at its base. *Seeds* with a small quantity of mucilaginous albumen; *embryo* curved; *cotyledons* leafy, shrivelled; *radicle* inferior next to the hilum. *Herbaceous plants* or *shrubs*, usually twining and milky, smooth, or with a simple pubescence; sometimes erect bushes. *Leaves* alternate, undivided or lobed, seldom pinnatifid, with no stipules. *Inflorescence* axillary or terminal; peduncles 1 or many-flowered, the partial ones generally with 2 bracts, which sometimes enlarge greatly after flowering (*Lindley*).

PROPERTIES.—The roots and seeds only have been used in medicine.

The tuberous roots of some species (as of jalap and scammony) contain an acrid, milky, purgative juice, which owes its medicinal qualities to the contained resin. *Mechoacan* and *Turpeth* (*Ipomœa Turpethum*) roots, formerly used as purgatives, are now obsolete. In other tuberous roots (as of *Rutata edulis*) the resin is deficient or absent, and starchy matter predominates; in consequence of which they become edible, and are cultivated for the table.

The seeds of some species (as of *Pharbitis cœrulea*) are cathartic.

181. CONVULVULUS SCAMMONIA, Linn.—THE SCAMMONY.

Sex. Syst. Pentandria, Monogynia.

(Gummi-resina c. resectâ radice emissâ, L. D.—Gummy resinous exudation from incisions into the root, E. D.)

HISTORY.—A purgative substance called scammony (σκαμμώνιον) was known to the Greeks long before the time of Hippocrates.¹ The Father of Medicine, who frequently employed it, says that it evacuates, both upwards and downwards, bile and mucus, and expels flatus.² Dioscorides³ notices the plant which yields scammony, and terms it σκαμμώνια. Pliny,⁴ also, speaks of scammony, which he calls *scammonium*.

Dr. Sibthorp⁵ refers the scammony of Dioscorides to *C. farinosus*, a Maderia species! on what ground does not appear, as this supposed species is not in his herbarium.⁶ If the ordinary reading of the text of Dioscorides be correct, this author represents the scammony as having hairy branches and leaves; which applies better to *C. sagittifolius* (*C. Sibthorpii*, Roemer and Schultes), found by Sibthorp in Samos and other islands of the Grecian Archipelago. This species is with great probability adopted by Dierbach⁷ as the source of the ancient scammony.⁸

BOTANY. *Gen. Char.*—*Sepals* 5. *Corolla* campanulate. *Style* 1. *Stigma*s 2, linear-cylindrical, often revolute. *Ovary* 2-celled, with 4 ovules. *Capsule* 2-celled (*Choisy*).

Sp. Char.—Stem smooth. Leaves sagittate, posteriorly truncate with entire or elongated slashed auricles. Peduncles very long, many-flowered. Sepals coloured, ovate, obtusely truncated, mucronulate, the external ones a little smaller, 2—3 lines long. Corolla campanulate, an inch long (*Choisy*).

Root perennial, tapering, 3 or 4 feet long, with an acrid, milky juice. *Stems* numerous, twining, herbaceous, smooth. *Leaves* on long petioles, acuminate, with pointed lobes at the base. *Peduncles* solitary, scarcely twice so long as the leaves. *Bracts* awl-shaped. *Sepals* obovate, truncated, with a reflex point, coloured at the edge. *Corolla* pale yellow, with purple stripes. *Stamina* shorter than the corolla; *anthers* erect, sagittate. *Style* as long as the stamens; *stigma*s white.

Hab.—Hedges and bushy places in Greece and the Levant.

PREPARATION.—The method of procuring scammony is, according to Dr. Russel,⁹

¹ Voigtels, *Arzneimittel*. Bd. i. S. 17; Bischoff, *Handb. d. Arzneimittell*. Bd. i. S. 40.

² *De Morb. Mul.* p. 597, ed. Foss.

³ *Lib.* iv. cap. 171.

⁴ *Hist. Nat. lib.* xxvi. cap. 38, ed. Valp.

⁵ *Prod. Fl. Græca*.

⁶ *Lindley, Fl. Medica*.

⁷ *Arzneimittel. d. Hippocrates*, S. 138.

⁸ Tournefort (*Voyage into the Levant*, vol. ii. p. 96, 1741) says that the scammony of Samos is collected from a hundred (*convolvulus*) whose leaves are larger, hairy, and slashed but their basis not so pretty as the seed of the Syrian scammony (*C. sagittifolius*). This doubtless is *C. sagittifolius*, which Sibthorp found in Samos.

⁹ *Med. Oss. and Inq.* vol. i. p. 13, 1776.

as follows: Having cleared away the earth from the upper part of the root, the peasants cut off the top in an oblique direction, about two inches below where the stalks spring from it. Under the most depending part of the slope they affix a shell, or some other convenient receptacle, into which the milky juice flows. It is then left about twelve hours, which time is sufficient for the drawing-off the whole juice; this, however, is in small quantity, each root affording but a few drachms. This milky juice from the several roots is put together often into the leg of an old boot, for want of some more proper vessel, when in a little time it grows hard, and is the genuine scammony.

Of this entirely pure scammony, says Dr. Russel, but very little is brought to market, the greater part of what is to be met with being adulterated, if not by those who gather it, by those who buy it of them abroad; for the chief part of what is brought hither passes through the hands of a few people, chiefly Jews, who make it their business to go to the villages of any note near which the scammony is collected (as Antioch, Shogre, Elib, Maraash, &c.), and then buying it while it is yet soft, they have an opportunity of mixing it with such other things as suit their purpose best—as wheat-flour, ashes, or fine sand, all of which he found it mixed with; but there seems, he adds, some other ingredient (possibly the expressed juice), which makes it so very hard and indissoluble that he was not able to discover it to his satisfaction.

Dioscorides thus describes the mode of procuring it: The head being separated, the root is to be excavated in the form of a dome (or vault) by a knife, so that the juice may flow into the cavity, from which it is to be taken out in shells. Others excavate the earth, and, having incised the root, let the juice run into the cavity, which has been previously lined with wainut leaves; when the scammony is dry, it is removed.

I have been informed by a Turkey merchant, who formerly resided at Smyrna, that scammony is brought into Smyrna, in the soft state, on camels. Here it is mixed with various impurities by persons (Jews) who are denominated scammony makers, and who adulterate it, and thereby lower its value to suit the market.

DESCRIPTION.—Scammony (*scammonium*; *gummi-resina scammonii*) is usually imported from Smyrna. Occasionally, it comes by way of Trieste. Still more rarely it is brought from Alexandretta (also called Scanderoon or Iskenderûn), the port of, and road to, Aleppo. It comes over in boxes and drums, which are frequently lined with tin.

I shall arrange¹ the different sorts of scammony of commerce under three heads: 1st, pure scammony; 2dly, adulterated scammony; 3dly, factitious scammony.

1. PURE SCAMMONY (*Scammonium purum*).—In English commerce one sort only is known under this name—namely, the virgin scammony. Scammony in shells is probably a pure scammony, but is unknown in trade. Trebizon or Samos scammony, though perhaps a pure scammony, differs so much in its external appearance from the ordinary commercial sorts, that it is unsalable here.

a. *Virgin Scammony* (*Lacryma*² *Scammony*; *Superior Aleppo Blackish*

¹ Marquart (*Pharm. Central-Blatt für 1837*, p. 671), who has published an elaborate paper on scammony. He arranges the various sorts as follows:—

1. *Scammony from the Convolvulaceæ*.—Under this head he includes
 - a. Aleppo scammony. Of this he makes five sorts.
 - β. Antioch scammony. Of this he makes three sorts.
 - γ. Samos scammony.
2. *Scammony from the Asclepiadææ*.
 - δ. French or Montpellier scammony.
3. *Scammony from the Apocynææ*.
 - ε. Smyrna scammony of commerce. Of this he makes four sorts.

But the foundation of this arrangement is erroneous. Smyrna scammony is not the produce of Apocynææ but of a smooth-leaved Convolvulus, as Sherard (Geoffroy, *Tract. de Mat. Med.* ii. 667) has shown. Under the head of Smyrna scammony, Marquart includes adulterated and factitious commercial sorts. In English commerce no distinction of Aleppo, Antioch, and Smyrna scammony is made.

² The term "*lacryma scammony*," I have heard applied to this sort of scammony by a Turkey merchant. It is remarkable that a somewhat similar term was used by the ancients. Celsus Aurelianus (*Acut. Moss.* lib. ii. cap. xxix.) speaks of "*succum scamoniæ quam diagridium appellamus*." Now *diagridium* is a corruption from *δακρύδιον*, *lacrymula*, a little tear. The word *diagridium* was also applied to a preparation of scammony.

Scammony, Guib.).—It usually occurs in amorphous pieces; but a careful examination of some large lumps has led me to believe that they formed portions of a mass, which, when in the soft state, had a rounded form. The whitish-gray powder, which covers some of the pieces, effervesces with hydrochloric acid; and I have no doubt, therefore, that the masses have been rolled in chalk. Virgin scammony is friable, easily reduced to small fragments between the fingers, or by the pressure of the nail, and has, according to my experiments, a sp. gr. of 1.210. Its fractured surface is resinous, shining, greenish-black; presents small air-cavities, and numerous gray semitransparent splinters, or fragments, when examined by a magnifying glass; and does not effervesce on the addition of hydrochloric acid. When rubbed with the finger moistened with ether, water, or saliva, it readily forms a milky liquid. If we examine thin fragments, or splinters, by transmitted light, we observe them to be semitransparent at the edges, and of a gray-brown colour. In the same piece we sometimes find some portions shining and blackish, as above described; while others are dull grayish. This difference depends probably, as Dr. Russel has suggested, on different methods of drying. Virgin scammony readily takes fire, and burns with a yellowish flame. Its odour is peculiar, somewhat analogous to old cheese; its taste is slight at first, afterwards acrid. The decoction of its powder, when filtered and cold, is not rendered blue by tincture of iodine. When incinerated in a crucible, it leaves a minute portion only of ash.

This sort of scammony is usually imported from Smyrna.

Porous, brittle, glistening on the fractured surface; emits no bubbles when hydrochloric acid is dropped on it; no blue colour is produced by the simultaneous addition of iodide of potassium and dilute nitric acid to water, in which powdered scammony has been digested at 170°. Ether should dissolve 78 grains out of 100 grains of scammony, *L.*

β. Scammony in shells or calabashes (Scammonium in testis; Sc. in calebassis).—Unknown in English commerce. It is described by continental writers as a very pure sort.

γ. Trebizon Scammony.—In 1832, a substance was imported into London, from Trebizon, under the name of scammony, which was unsalable here. The sample which I received is a portion of cake apparently round, flat below, and convex above. Its colour is light-grayish or reddish-brown; when moistened, the surface becomes glutinous and odorous; its taste is sweet, nauseous, and somewhat bitter. In its external appearance it has more resemblance to benzoin than scammony.

This, probably, is the *Scammony of Samos* mentioned by Tournefort;¹ the *Scammony from Mysia* of Dioscorides. It would appear to be obtained from a species of *Convolvulus* (*C. Sagittifolius*) different from that which yields the Aleppo and Smyrna scammony; for both Dioscorides and Tournefort state that the leaves are hairy.

2. ADULTERATED SCAMMONY (*Scammonium adulteratum*).—Under this head are included the various sorts of scammony commonly found in the shops, and which English dealers distinguish as *seconds*, *thirds*, &c. To this division belongs the so-called *Antioch scammony* (*scammonium antiochum*) of continental writers. What is sometimes called on the continent *Smyrna scammony* (*scammonium smyrnense*), is either adulterated or factitious scammony. The term *Aleppo scammony* (*scammonium halepense* seu *aleppicum*) is applied by the same writers to virgin scammony, and to the better sorts of adulterated scammony.² The different sorts of adulterated scammony more frequently occur in round flattened or plano-convex cakes of variable size, usually an inch or two in thickness, and about five inches in diameter. Some are met with in amorphous, irregular lumps; others in large cylindrical or drum-shaped masses.

The different sorts of adulterated scammony vary considerably in appearance, but pass so insensibly the one into the other that it is impossible to classify them according to their physical characters. I shall, therefore, arrange them according to their chemical characters.

A. *Adulterated Scammony, which effervesces on the addition of hydrochloric*

¹ *A Voyage into the Levant*, vol. ii. p. 96, 1741.

² I have a specimen of scammony, sent to a friend of mine for sale from Aleppo, which is so adulterated that no offer can be obtained for it. It is in thin flat cakes, which have a sweet smell, and contain the starch of either wheat or barley—probably of the former.

acid.—This is sophisticated with carbonate of lime, and sometimes with starch or dextrine also.

α. *Calcareous, Chalky, or Cretaceous Scammony*.—Occurs in round flat cakes, or in irregular lumps. It is more ponderous than the virgin sort, and usually breaks with a dull and earthy fracture. Its colour is ash-gray, like common secondary limestone. A specimen in irregular lumps I found to have the sp. gr. of 1.463.

Its chemical characters are as follows: hydrochloric acid applied to a fractured surface causes effervescence; iodine produces no change of colour when added to the filtered decoction after it has become cold.

Lumps of crystallized carbonate of lime are sometimes found in this sort of scammony.

β. *Calcareo-Amylaceous Scammony*.—This, like the preceding, occurs in round flat cakes or in irregular lumps, which contain carbonate of lime and either wheat or barley starch or meal.¹ I have also met with it in cylindrical or drum-shaped masses.

αα. *In irregular lumps*.—It sometimes resembles pure scammony in its glossiness and dark resinous appearance; but usually it has a waxy lustre and grayish colour.

ββ. *In cylindrical or drum-shaped masses*.—This kind is imported either in boxes or drums, into which it seems to have been introduced when soft, and to have hardened subsequently—hence its form is that of the package in which it was imported. A sample of a circular cake (about 12 inches in diameter, and several inches thick) presents a dull-grayish fracture. Its sp. gr., according to my experiments, is 1.359.

γγ. *In circular flat cakes*.—I have received this sort of scammony in the form of circular flat cakes, about five inches in diameter, and one inch thick. They are heavy, dense, and much more difficult to fracture than the preceding kinds. The fractured surface, in some samples, is resinous and shining, in others dull; it has air-cavities, and numerous small white specks (chalk); its colour is grayish to grayish-black. The sp. gr. varies, in different samples, from 1.276 to 1.543. I have received portions of five cakes of this variety of scammony, on which were marked the actual quantity of chalk which had been intermixed in each sample. In 100 parts of the cakes the proportions of chalk were respectively as follows: 13.07, 23.1, 25.0, 31.05, and 37.54. These numbers were furnished by the Levant importer to one of our most respectable wholesale druggists, from whom I received them.

The chemical characters of calcareo-amylaceous scammony are as follows: hydrochloric acid applied to a fractured surface causes effervescence; iodine produces a blue colour when added to the filtered decoction after it has become cold.

γ. *Calcareo-dextrinous Scammony*.—This sort differs from the preceding in the circumstance that iodine produces a reddish-purple tint when added to the filtered decoction after it has become cold. It appears to contain carbonate of lime and dextrine.

B. *Adulterated Scammony, which does not effervesce on the addition of hydrochloric acid*.—This sort of scammony is usually sophisticated with wheat-meal.

δ. *Amylaceous Scammony*.—This sort of scammony is adulterated with the starch or flower of either wheat or barley—probably the former; it is of less frequent occurrence than the calcareo-amylaceous kind. It occurs in irregular lumps and round flat cakes, which sometimes have a resinous fracture and a dark colour

¹ Dioscorides states that the Syrian scammony is adulterated with *αἰσχροῦ* (*euphorbia* or *spurge*) and *ἀνισόνος ἀσπέρης* (*meal of the evil or bastard lentil, the Ervum Ervilia of Linn*). A careful microscopic examination of amylaceous and calcareo-amylaceous scammony has satisfied me that the starch used for adulterating these sorts of scammony, at the present day, is that of either wheat or barley—I think of wheat.

like pure scammony, but which more commonly have a waxy lustre and a grayish colour. It contains starch and ligneous matter, but not chalk. It does not, therefore, effervesce with hydrochloric acid. Its decoction, when filtered, and cooled, strikes a blue colour on the addition of iodine.

1. *Selenitic or Gypseous Scammony*.—This kind has been described by Marquart. Its sp. gr. was 1.731, and it contained no less than 52 per cent. of gypsum (sulphate of lime).

2. *Bassorin Scammony*.—Marquart met with a scammony which had a horny consistence and a sp. gr. of 1.167. After it had been deprived of its resin and extractive, it swelled up in boiling water. The constituent which thus swelled up was soluble in caustic potash; Marquart regarded it as bassorin.

In the Museum of the Pharmaceutical Society is a specimen of scammony which is supposed to be adulterated with tragacanth and some resin.

3. *Indian Scammony*.—From my friend Dr. Royle I have received a sample of scammony met with in the Indian bazaars. It is light, porous, of a greenish-gray colour; gritty under the teeth, as if containing a considerable quantity of sand, and having a balsamic olibanum-like odour.

3. **FACTITIOUS SCAMMONY** (*Scammonium factitium*).—To this division belongs part of the so-called *Smyrna scammony* of continental commerce, as well as *French* or *Montpellier scammony*. I have met with three samples of factitious scammony.

a. Under the name of *Smyrna scammony*, I purchased of a London dealer a sort of scammony in the form of circular flat cakes, about half an inch thick. It is blackish, and has, externally, a slaty appearance; it breaks with difficulty; its fracture is dull and black. Its sp. gr. is 1.412. Moistened and rubbed, it evolves the smell of guaiacum. Boiled with water, it yields a turbid liquor (which is not rendered blue by iodine), and deposits a blackish powder; the latter, boiled with alcohol, yields a solution which becomes greenish-blue on the addition of nitric acid, showing the presence of guaiacum.

It is probably the common *Smyrna scammony* (*Scammonium smyrnense factitium*) of Gray,¹ who directs it to be made with Aleppo scammony, 1 lb.; extract of jalap, 5 lbs.; guaiacum resin, 10 lbs.; sago, 10 lbs.; and ivory black, 4 lbs.

β. Under the name of *Scammonium smyrnense medicinale venale*, M. Batka has presented to the Pharmaceutical Society a spurious scammony said to be made up of gum, bread, scammony, guaiacum, benzoin, wax, sand, and wood.

γ. *French or Montpellier Scammony* (*Scammonium gallicum seu monspeliacum*).—This substance is made, in the southern part of France, with the expressed juice of *Cynanchum monspeliacum*, mixed with different resins and other purgative substances. It occurs in semicircular, blackish, hard, compact cakes, which frequently have the smell of balsam of Peru.

COMPOSITION. α. **Of the Root**.—The dried root of *Convolvulus Scammonia* was analyzed, in 1837, by Marquart,² who obtained from it the following substances: resin 4.12, sugar, convolvulin, and extractive 13.68, resin and wax 0.55, gum, 5.8, extractive 2.4, starch 7.0, extractive soluble in hot, but not in cold water 1.4 [salts and woody fibre 65.05]. The resin, the wax, and a portion of the gum, are contained in the milky juice of the latex vessels (*vasa laticis*); while the sugar, gum, extractive, and salts dissolved in water, constitute the juice of the cells; and in this juice the starch-globules float.

1. **RESIN**.—This is analogous to that of the scammony of commerce.

2. **CONVOLVULIN**.—A substance supposed by Marquart to be a vegetable alkali. It reacts feebly as a vegetable alkali, and is precipitated from its watery solution by tincture of nutgalls. Marquart thinks it probably exists in jalap.

β. **Of Scammony**.—Bouillon-Lagrange and Vogel³ analyzed two kinds; one called Aleppo, the other Smyrna scammony. Marquart⁴ analyzed twelve kinds; of these, eight sorts (five called Aleppo, and three Antioch scammony) he considers to be the produce of *Convolvulus Scammonia*; while the remaining four, which, he says, are called in commerce *Smyrna scammony*, he erroneously ascribes to *Periploca Scamone*, Linn. Three of these, however, appear to be adulterated sorts, and one (the 12th) is obviously factitious.

¹ Supplement to the Pharmacopœia, 3d edit. 1824.

² Bulletin de Pharmacie, t. i. p. 421, 1809.

³ Pharm. Central-Blatt für 1837, S. 687.

⁴ Pharm. Central-Blatt für 1837, p. 687.

	ALERPO SCAMMONY, <i>Marq.</i>						ANTIOCH SCAMMONY, <i>Marq.</i>				SMYRNA SCAMMONY, <i>Marq.</i>			
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.		No. 6.	No. 7.	No. 8.		No. 9.	No. 10.	No. 11.	No. 12.
Resin	In shells. Sp. gr. 1.2	Irregular pieces. Sp. gr. 1.239	Broken cakes. Sp. gr. 1.403.	Flat pieces. Sp. gr. 1.421.	Irregular pieces Sp. gr. 1.731.		Round cakes. Sp. gr. 1.171.	Angular pieces. Sp. gr. 1.120.	Flat cakes. Sp. gr. 1.167.		Round cakes. Sp. gr. 1.428.	Round cakes. Sp. gr. 1.503.	Broken pieces. Sp. gr. 1.363.	Round cakes. Sp. gr. 1.376. (Fictitious.)
Wax	81.25	78.5	77.0	50.0	32.5		18.5	16.0	8.5	Alpha resin, with traces of wax	4.50	5	5.00	25.00
Extractive	0.75	1.5	0.5	—	—		—	0.5	—	Beta resin	1.50	1	2.00	12.00
Extractive with salts	4.50	3.5	3.0	5.0	3.0		7.0	10.0	8.0	Extractive taken up by alcohol	3.00	11	15.00	4.00
Extractive with salts	—	2.0	1.0	3.0	4.0		6.0	5.0	12.0	Extractive taken up by water . .	10.00	18	8.00	13.00
Gum with salts	3.00	2.0	1.0	1.0	1.5		2.5	3.0	8.0	Gum, with sulphate of lime . .	21.00	20	7.00	5.00
Starch	—	1.5	—	5.0	—		15.5	36.0	17.0	Mucilage	19.50	5	9.00	13.00
Starchy envelops, bassorin, and gluten	1.75	1.25	—	5.0	—		7.0	12.5	24.0	Starch	—	23	15.00	5.00
Albumen and woody fibre	1.50	3.5	3.5	4.5	2.0		6.5	12.5	16.5	Colouring matter	—	2	—	—
Ferruginous alumina, chalk, and carbonate of magnesia	3.75	2.75	12.5	22.5	6.75		12.5	1.5	1.0	Woody fibre, oxides, extractive, &c.	33.00	11	35.00	18.00
Sulphate of lime	—	—	—	—	52.00		22.5	—	—	Inorganic salts, silica, &c. . . .	7.50	4	4.00	5.00
Sand	3.50	3.5	2.0	4.0	—		2.0	3.0	4.0					
	100.00	100.00	100.5	100.0	101.75		100.5	100.0	99.0		100.00	100	100.00	100.00

Dr. Christison¹ has analyzed both pure and adulterated scammony. His results are as follows:—

	PURE SCAMMONY.			ADULTERATED SCAMMONY.					
	Old.	Old.	Moist.	Calcareous.			Amylaceous.		Calcareo-Amylaceous.
Resin	81.8	83.0	77.0	64.6	56.6	43.3	37.0	62.0	42.4
Gum	6.0	8.0	6.0	6.8	5.0	8.2	9.0	7.2	7.8
Starch (fecula)	1.0	—	—	—	1.4	4.0	20.0	10.4	13.2
Lignin and sand	3.5	3.2	5.0	5.2	7.1	7.8	22.2	13.4	9.4
Chalk	—	—	—	17.6	25.0	31.6	—	—	18.6
Water	7.7	7.2	12.6	6.4	5.2	6.4	12.0	7.5	10.4
	100.0	101.4	100.6	100.6	100.3	101.3	100.2	100.5	101.8

ADULTERATION.—The characters of good scammony are as follows: It readily fractures between the fingers, or by the pressure of the nail; its sp. gr. is about 1.2; its fracture is dark, glistening, and resinous; its fractured surface should not effervesce on the addition of hydrochloric acid; the decoction of the powder, filtered and cooled, is not rendered blue or purplish by tincture of iodine; paper moistened with an alcoholic or ethereal tincture of scammony should undergo no change of colour when exposed to brown nitrous fumes (produced by pouring a drachm of strong nitric acid over some filings of zinc, iron, or copper, contained in a tumbler or wineglass; 100 grains, incinerated with nitrate of ammonia, yield about three grains of ashes (according to my experiments); sulphuric ether separates at least 78 per cent. of resin (principally), dried at 280° F.

“Fracture glistening, almost resinous, if the specimen be old and dry; muriatic acid does not cause effervescence on its surface; the decoction of its powder, filtered and cooled, is not rendered blue by tincture of iodine. Sulphuric ether separates at least 80 per cent. of resin dried at 280°.”—*Ph. Ed.*

Hydrochloric acid detects the presence of carbonates; iodine added to the cooled decoction of scammony detects starch and dextrine; by nitrous fumes the presence of guaiacum resin may be detected, for they give a blue colour to paper which has been moistened with tincture of guaiacum; incineration detects an abnormal amount of inorganic matter, as chalk, gypsum, or sand; ether determines the amount of resinous matter present.² The microscope serves to detect the presence and sort of starch or meal used for adulterating. Hitherto, the only starch I have detected in adulterated scammony is that of a cereal, either wheat or barley—probably the former (see *ante*, p. 512).

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—The experiments of Orfila³ lead us to infer that scammony is not poisonous. “We have,” says he, “frequently administered four drachms of it to dogs who had the œsophagus afterwards tied, and have only observed alvine evacuations.” On horses and other herbivorous animals its operation is very uncertain. Gilbert⁴ states that six drachms killed a sheep in twenty days, without having caused purging. Viborg⁵ says half an ounce given to a dog caused several loose stools; the same dose had no effect on a badger. It is probable, however, that in all the experiments now referred to, adulterated scammony was employed.

β. On Man.—The effects of pure scammony are those of a powerful and drastic purgative. As the greater part of the commercial drug is largely adulterated, practitioners are, I suspect, scarcely acquainted with the operation of the genuine article, which appears to me to possess nearly double the activity of that usually

¹ *Dispensatory.*

² For further details, see a paper *On the Adulteration of Scammony*, by the author, in the *Pharmaceutical Journal*, vol. iv. p. 267, 1845.

³ *Toxicol. Gen.*

⁴ *Wibmer, Werk. d. Arzn. u. Gifte*, Bd. ii. S. 181.

⁵ *Moiroud, Pharm. Vét.* p. 271.

found in commerce. As the evacuant powers of scammony depend on its local irritation, it operates more energetically when there is a deficiency of intestinal mucus, and is then very apt to gripe; and *vice versa*, when the intestines are well lined with secretion, it passes through with much less effect. In its operation scammony is closely allied to jalap, than which it is more active, while its odour and taste are less nauseous. It is less irritant than gamboge.

USES.—Scammony is, of course, inadmissible in inflammatory conditions of the alimentary canal, on account of its irritant qualities. It is well adapted for torpid and inactive conditions of the abdominal organs, accompanied with much slimy mucus in the intestines. It is principally valuable as a smart purgative for children, on account of the smallness of the dose necessary to produce the effect, the slight taste, and the energy, yet safety, of its operation. When used for them, it is generally associated with calomel. Where a milder purgative is required, it may be conjoined with rhubarb, sulphate of potash, and an aromatic. It may be employed to open the bowels in constipation; to expel worms, especially of children; to act as an hydragogue purgative, on the principle of counter-irritation, as in affections of the head and dropsies; and for any other purpose for which an active cathartic may be required.

ADMINISTRATION.—For an adult, the usual dose of commercial scammony is ten grains to a scruple; but, of virgin scammony, from ten to fifteen grains. In order to diminish its irritant and griping qualities, it should be finely divided. For this purpose it may be intimately mixed with some bland powder (as gum, starch, sugar, &c.), or made into an emulsion with milk.

1. PULVIS SCAMMONII COMPOSITUS, L. D.; *Compound Powder of Scammony*.—(The *London College* directs it to be prepared with Scammony, Hard Extract of Jalap, of each ℥ij; Ginger ℥ss. Rub them separately to very fine powder; then mix them. The *Edinburgh College* directs it to be made of equal parts of Scammony and Bitartrate of Potash, triturated together to a very fine powder. The *Dublin College* orders of Scammony, in fine powder, ℥j; Compound Powder of Jalap ℥ij. Mix thoroughly by trituration, and pass the powder through a fine sieve.)—The effects of scammony and of extract of jalap being very similar, little or no advantage can be obtained by the intermixture of these substances. The ginger is intended to correct the griping of the other ingredients. The bitartrate of potash, used by the *Edinburgh College*, can do little more than serve to divide the scammony. Compound powder of scammony is cathartic; and is used as a smart purge for children, especially where much mucous slime is contained in the bowels, and in worm cases. The dose of the *London* and *Dublin* preparation, for an adult, is from grs. x. to ℥j; for children under a twelvemonth old, from grs. iij. to grs. v. The dose of the *Edinburgh* preparation, for an adult, is from grs. xv to ℥ss.

2. PULVIS SCAMMONII CUM CALOMELANE; *Powder of Scammony with Calomel*.—(Scammony ℥j; Calomel, Sugar, of each ℥ss. Mix.)—Though this preparation is not contained in any of the British pharmacopœias, yet the frequency of its employment in the diseases of children is a sufficient apology for its introduction here. Dose, for an adult, grs. x to grs. xx; for children, from grs. iv to grs. x, according to the age of the patient.

This preparation may be employed as a substitute for the old *Pulvis Basilicus*, or *Royal Powder*, which consisted of equal parts of scammony, calomel, cream of tartar, and antimonie acid.

3. CONFECTIO SCAMMONII, L.; *Electuarium Scammonii*, D.; *Confection of Scammony*.—(Scammony, powdered, ℥jss; Cloves, bruised; Ginger, powdered, each ℥vj; Oil of Caraway f℥ss; Syrup of Roses as much as may be sufficient. Rub the dry ingredients together to very fine powder, and preserve them; then, whenever the confection is to be used, the syrup being gradually poured in, rub again; lastly, the oil of caraway being added, mix them all, L.—The *Dublin College* orders of Scammony, in fine powder, ℥ij; Ginger, in fine powder, ℥iss; Oil of

Caraway fʒj; Oil of Cloves fʒss; Simple Syrup fʒiij; Clarified Honey, *by weight* ʒiiss.)—A warm or aromatic cathartic. Dose, for an adult, ʒj to ʒj; for children, grs. iij to grs. x. It is seldom employed.

4. **EXTRACTUM** *sive* **RESINA SCAMMONII**, E.; *Extract or Resin of Scammony*.—(Take any convenient quantity of scammony in fine powder; boil it in successive portions of proof spirit till the spirit ceases to dissolve anything; filter; distil the liquid till little but water passes over. Then pour away the watery solution from the resin at the bottom; agitate the resin with the successive portions of boiling water till it is well washed; and, lastly, dry it at a temperature not exceeding 240°.)—To obtain pure resin of scammony, alcohol or ether should be used instead of proof spirit. It is brownish, and in thin layers transparent; when heated, it evolves a peculiar, not disagreeable odour; it is fusible and combustible. It is soluble in alcohol, ether, and oil of turpentine.

Resin of jalap is insoluble in oil of turpentine, and nearly so in ether; whereas scammony resin is readily soluble in these liquids. By these peculiarities the two resins may be distinguished from each other.

The alcoholic solution of scammony resin is feebly acid; the addition of water causes a white precipitate (*hydrate of resin*). Precipitates (*metallic scammoniates*?) are also produced by alcoholic solutions of the acetate of lead and the acetate of copper. Caustic potash deepens the colour of the solution.¹ Scammony resin may be decolorized by animal charcoal without having its purgative qualities affected.² Its composition, according to Mr. Johnston,³ is $C^{40}H^{38}O^{20}$. It is "remarkable for containing the largest quantity of oxygen of any resin hitherto analyzed." (Johnston.) When pure or virgin scammony can be obtained, the resin is an unnecessary preparation. Scammony resin is a drastic cathartic. Dose, grs. viij to grs. xij. When administered, it should be intimately divided, either by some bland powder, or still better by an emulsion.

5. **TINCTURA SCAMMONII**; *Tincture of Scammony*; *Tincture de Scammonée*.—Codex, Pharm. Française, 1837.—(Aleppo Scammony 1 part; Rectified Spirit 4 parts by weight; macerate for fifteen days and filter.)—Dose, fʒss to fʒj diffused through a mucilaginous mixture of milk.

6. **MISTURA SCAMMONII**, E.; *Mixture of Scammony*.—(Resin of Scammony gr. viij; Unskimmed Milk fʒiij. Triturate the resin with a little of the milk, and gradually with the rest of it till a uniform emulsion is formed.)—This is an imitation of *Planche's purgative potion*, except that two drachms of sugar and three or four drops of cherry-laurel water are omitted. It is one of the most agreeable draughts that can be taken.

182. EXOGONIUM PURGA, *Bentham*.—TURE JALAP.

Sez. Syst. Pentandria Monogynia.
(Tuber, L. D.—Root, E. D.)

HISTORY.—De Paiva¹ thinks that Jalap was known to Dodoens in 1552, to Monardes in 1568, and to Clusius in 1574.² But Bauhin³ (who calls it *Bryonia Mechoacana nigricans*) says it was brought from India, under the name of *Chelapa*, or *Udapa*, about eleven years before the time he wrote (the date of the preface to his work is 1620); that is, about 1609 or 1610. Its name seems to be derived from Xalapa, a town of Mexico.

The jalap plant has been successively declared to be a *Mirabilis*, a *Convolvulus*, an *Ipomœa*, and an *Erogonium*.

The *Convolvulus Jalapa* described and figured by Woodville⁴ and Desfontaines,⁵

¹ Marquart, *op. cit.*

² *Phil. Trans.* for 1840, p. 341.

³ See some remarks on this subject in *Pharm. Central-Blatt für 1844*, S. 955—6.

⁴ *Prodromus*, p. 135.

⁵ *Ann. Mus. d'Hist. Nat.* t. ii.

² *Journ. de Pharm.* t. xiii. p. 589.

³ Voigtel's *Arzneimittell.* Bd. i. S. 117.

⁴ *Med. Bot.* p. 59.

is now well known to yield none of this drug. The real jalap plant was first described by Mr. Nuttall;¹ but the name (*Ipomæa Jalapa*) he gave to it had been already applied by Pursh to another plant. In the same year Dr. Schiede² and Dr. Wenderoth³ noticed it; the latter called it first *Convolvulus Purga*, and afterwards *Ipomæa Purga*. In 1832 it was described and figured by Zuccarini,⁴ under the name of *Ipomæa Schiedeana*.

Choisy, in De Candolle's *Prodromus* (vol. ix. p. 374), has adopted Wenderoth's name of *Ipomæa purga*; but as the jalap plant has a salver-shaped (hypocrateriform) corolla and exserted stamens, it certainly cannot be an *Ipomæa*, a part of whose character is a campanulate corolla and inclosed stamens.

BOTANY. Gen. Char.—*Sepals* 5. *Corolla* tubular. *Stamens* exserted. *Style* 1. *Stigma* capitate, 2-lobed. *Ovary* 2-celled; the cells 2-seeded. (Choisy.)

Sp. Char.—*Root* tuberose; incrassated, perennial. *Stems* annual, twining, branched, smooth. *Leaves* ovate, acuminate, cordate at the base, quite entire, and smooth on both sides. *Peduncles* 1- to 3-flowered. *Sepals* unequal, obtuse, smooth. *Corolla* salver-shaped, with a subclavate, cylindrical tube, and a subpentagonal, horizontally-expanded limb.

Root perennial, irregularly ovate-conical, terminating inferiorly in some subcylindrical fibrous branches; covered by a very thin, dirty, blackish epidermis; internally white and fleshy. *Stem* herbaceous. *Leaves* alternate, petioled. Tube of the *corolla* purplish violet (red lake).

Hab.—In the woods of the Mexican empire, near Chicanquiaco, at an elevation of nearly 6,000 feet above the level of the sea. Jalapa is the only market for the root, from whence it is exported to Europe and the United States by way of Vera Cruz.

IPOMÆA ORIZABENSIS, Ledanois; *Convolvulus, Orizabensis*, Pelletan, Journ. de Chim. Med. t. x. p. 10, 1834. *Ipomæa batatoides*, Benthani, Bot. Regist. Jan. 1841. *Ipomæa? Mestilamici*, Choisy, De Cand. Prodr. ix. 389.—This plant grows in the environs of Orizaba and near Mestitlan in Mexico. It yields an inferior sort of jalap, called *light*, *fusiform*, or *male jalap*.

DESCRIPTION.—1. The dried tubers of true jalap (*radix jalapæ*; *rad. jalapæ tuberosæ* vel *ponderosæ*) found in commerce rarely exceed a pound each in weight. They vary in size, from that of the fist to that of a nut. When entire, they are usually more or less oval, and pointed at the two opposite extremities. The larger tubers are frequently incised, apparently to facilitate desiccation. They are covered with a thin, brown, wrinkled cuticle. They should be heavy, hard, and difficult to powder. When broken, good tubers should present a deep yellowish-gray colour, interspersed with deep brown concentric circles. The slices vary in their shape, colour, and other properties. Those of inferior quality, are light, *whitish*, friable; they usually appear to be quarter segments of transverse slices, and are sometimes called *spurious jalap*, or, from their shape, *cocked-hat jalap*. Jalap is very apt to become worm-eaten; but the insects which attack it devour the amylaceous matter and ligneous matter, and leave the resin. Hence *worm-eaten jalap* is well adapted for the preparation of extract.

2. A *spurious jalap*, called in Mexico *male jalap*, is sometimes found intermixed with the genuine sort. It was first described by Mr. D. B. Smith;⁵ and has been termed by Guibourt *light* or *fusiform jalap*. It is the kind sometimes called in English commerce *woody jalap* or *jalap wood*, and which in Germany has been termed *jalap stalks* (*stipites jalapæ*). It is the produce of *Ipomæa Orizabensis*, Ledanois. As met with in commerce, it is in slices or segments, which are more fibrous or woody than genuine jalap. The cut surface is often darker from exposure to the air, and uneven from the unequal shrinking in the drying process. Internally, the colour is whitish. The odour and taste are similar to, but feebler than, the true jalap.

¹ *American Journal of Medical Sciences* for February, 1830.

² *Linnaea*, v. 3, July, 1830, p. 473; and *Pharm. Central-Blatt* für 1830, p. 408.

³ *Pharm. Central-Blatt* für 1830, p. 456; and *Linnaea*, viii. 515.

⁴ *Acta Acad. Reg. Monacensis*, vol. x.

⁵ *American Journal of Pharmacy*, vol. ii. p. 22.

3. Guibourt¹ has described a *false rose-scented jalap*. It is in tubercles which are not so dark-coloured as the genuine drug. They are deeply furrowed; the prominent parts of the furrows being white from the friction of the pieces against each other; the depressions being dark coloured. The pieces are but slightly resinous, are amylaceous and saccharine, and have rather an agreeable sweetish odour, which Guibourt compares to that of oil of rhodium or of the rose. It possesses scarcely any purgative action. It is probably the kind known in the American market as *overgrown jalap*.

SELECTION.—Jalap is more active as a cathartic in proportion to the quantity of resin which it contains; plump, firm, heavy, resinous pieces, therefore, are preferable. Light, whitish, amylaceous, shrivelled, or woody pieces are objectionable.

COMPOSITION.—Jalap was analyzed, in 1817, by Cadet de Gassicourt,² and more recently by Gerber.³ Other less complete analyses have been made by Henry,⁴ by Ledanois,⁵ and by Nees v. Esenbeck and Marquart.⁶ In 1835, Canobio analyzed a variety of jalap called *gialappone*,⁷ similar in appearance to galanga.

Gerber's Analysis.		Henry's Analysis.			
			Light.	Sound.	Worm-eaten.
Hard resin	7.8				
Soft resin	3.2				
Slightly acid extractive	17.9	Resin	12	9.6	14.4
Gummy extractive	14.4	Extractive	15	28.0	25.0
Colouring matter	8.2	Starch	19	20.4	20.6
Uncrystallizable sugar	1.9	Woody fibre	54	42.0	40.0
Gum, with some salts	15.6				
Bassorin	3.2	Jalap	100	100.0	100.0
Vegetable albumen	3.9				
Starch	6.0				
Water	4.8	Nees v. Esenbeck and Marquart's Analyses.			
Malic acid and malates of potash and lime	2.4		Root of <i>Exogonium</i> <i>Purga</i> .	Commercial Jalap.	False Jalap.
Chlorides of calcium and potassium	1.4				
Phosphates of magnesia and lime	1.7	Extractive	20.416	27.50	6.66
Carbonate (?) of lime	3.0	Resin	12.083	13.33	18.33
Loss	4.6	Matters insoluble in alcohol	67.500	59.16	75.00
Jalap	100.0		100.000	100.00*	100.00

The following are analyses by Ledanois and Guibourt:—

Ledanois's Analysis.		Guibourt's Analyses.		
	Male, light, or fusiform Jalap.		Official Jalap.	False rose- scented Jalap.
Resin	8.0	Resin	17.65	3.23
Gummy extract	25.6	Liquid sugar by alcohol	19.00	16.47
Starch	3.2	Brown saccharine extract obtained by water	9.05	5.92
Albumen	2.4	Gum	10.12	3.88
Woody fibre	58.0	Starch	18.78	22.69
Water and loss	2.8	Woody fibre	21.60	46.00
		Loss	3.80	1.81
Jalap	100.0	Jalap	100.00	100.00

1. JALAP RESINS.—The resinous portion of jalap is the most important, because it is the active ingredient of this root. The substance generally known as *jalap resin* is obtained by mixing the alcoholic tincture of jalap (prepared by percolation or digestion) with water. The precipitated resin is to be washed with warm water, and then dissolved in alcohol. By evapora-

¹ *Pharmaceutical Journal*, vol. ii. p. 331, 1842.

² *Guélin, Handb. d. Chemie*, Bd. ii. S. 1299.

³ *Journ. de Chim. Méd. t. v. p. 508.*

⁴ *Ibid. für* 1835, S. 304.

⁵ *Journ. de Pharm. t. iii. p. 495.*

⁶ *Bull. de Pharm. t. ii. p. 87.*

⁷ *Pharm. Central-Blatt für* 1834, S. 695.

tion the tincture yields the resin. Planché¹ has proposed another process. By digestion with animal charcoal the alcoholic solution of the resin is rendered nearly colourless, and by evaporation yields an almost colourless resin (*resina jalapæ alba* of Martius.)² Jalap resin is soluble in alcohol, but insoluble in water. Triturated with milk, it does not form an emulsion, but its particles unite into a solid mass. By this it may be distinguished from scammony resin³. It is insoluble in the fixed and volatile oils. Its insolubility in oil of turpentine is a means of detecting the intermixture of some other resins, as of scammony and turpentine.⁴ Jalap resin is sometimes adulterated with guaiacum.⁵ This, unlike jalap resin (rhodeoretin) is soluble in ether; and paper moistened with its alcoholic solution is rendered blue by nitrous gas. Decolorized jalap is composed, according to Goebel,⁶ of carbon 36.62, hydrogen 9.17, and oxygen 53.91; but Johnston⁷ declares this analysis to be incorrect, and gives the following as the formula for the resin, $C^{40}H^{34}O^{15}$.

According to Buchner and Herberger,⁸ as also Kayser,⁹ the so-called jalap resin consists of two distinct resins, one soluble in ether, the other insoluble in this liquid.

a. Jalapin : *Rhodeoretin* (from *ῥόδεος*, rose-red, and *πῦρην*, resin.) $C^{42}H^{35}O^{20}$. Is this the jalapin of Mr. Hume?¹⁰ This resin is insoluble in ether. Kayser obtained it by boiling purified jalap resin in ether, which took up the jalapic acid and left the jalapin. According to Buchner and Herberger it constitutes not quite nine-tenths of jalap resin. It is a transparent, colourless, odourless, and tasteless resin; very soluble in alcohol, but insoluble in water and in ether.

It does not possess basic properties, as Buchner and Herberger supposed; but, on the contrary, possesses acid properties, reddens litmus, and is soluble in ammonia and acetic acid. If the salt which it forms with oxide of lead be decomposed by sulphureted hydrogen, the resin is then found to have combined with the elements of water and to have become converted into *hydrorhodeoretin*, $C^{42}H^{36}O^{21}$.

β. Jalapic acid : *Odorous Principle of Jalap*?—Constitutes thirteen per cent. of jalap resin. It is a brown, soft, and greasy substance, which reacts as an acid, has the odour of jalap, and an acid taste. By long contact with water it crystallizes. It is soluble in ether, in alcohol, and in alkaline solutions; but is insoluble in hydrochloric acid. It is either a crystallizable soft resin or a fatty acid.

Pararhodeoretin; $C^{42}H^{34}O^{18}$.—This is a simple resin, and is obtained from the male or fusiform jalap (*Ipomœa orizabensis*.) It is soluble in both alcohol and ether.

If jalap resin (rhodeoretin or pararhodeoretin) be digested in a watch-glass with oil of vitriol, a crimson coloured solution is obtained, from which in a few hours a brown viscid resin will separate. By this test jalap resin is distinguished from other resins.

2. *Starch*.—The starch grains vary in size. Their shapes are spheres, semispheres, or that of mullars. The hilum is very distinct.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally*.—Jalap root in powder, as well as the resin obtained from it, is a local irritant. Its operation on the bowels is well seen in the *carnivora*. Cadet de Gassicourt¹¹ found that the resin applied to the pleura, peritoneum, or intestinal canal of dogs, caused fatal inflammation. Two drachms introduced into the stomach, the œsophagus being afterwards tied, killed a dog in a few hours. It is remarkable, however, that the same experimenter observed no particular effect from the application of a drachm of the finely-powdered resin to the cellular tissue of the back. Moreover, 24 grains, with the yolk of an egg, injected into the jugular vein, had, he says, a very slight effect; indeed, at first none was observed, but the two following days the animal had soft, pale evacuations, and lost his appetite, though he soon recovered from this state. In the *herbivora*, it proves a very uncertain purgative. Gilbert¹² gave two ounces to a sheep, without observing any effect. Donne¹³ administered two or three ounces to horses, without observing any remarkable effect, except increased secretion of urine.

β. On Man.—In the human subject jalap acts as a powerful and drastic purgative, producing copious liquid stools, and, when judiciously exhibited, is both safe and efficacious. Its objectionable effects are, that while in the stomach it causes

¹ Soubeiran, *Traité de Pharm.* t. ii. p. 28.

² Planché, *Journ. de Pharm.* t. xviii. pp. 191—5.

³ *Pharm. Central-Blatt für* 1832, 837; and *für* 1838, S. 904.

⁴ *Pharmaceutical Journal*, vol. iii. p. 132, 1843.

⁵ *Phil. Trans.* for 1840, p. 343.

⁶ *Ann. der Chem. u. Pharm.* Bd. li. p. 81, 1844; and *Pharm. Journal*, vol. iv. p. 327, 1845.

⁷ *Med. and Phys. Journ.* for April, 1824, p. 346.

⁸ Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. iii. S. 181.

⁹ Moiroud, *Pharm. Vét.* p. 269.

² *Pharm. Central-Blatt für* 1835, S. 557.

⁶ *Pharm. Waarenk.* Bd. ii. S. 59.

⁸ *Pharm. Central-Blatt für* 1831, S. 284.

¹³ *Ibid.*

frequently nausea, and sometimes vomiting; while, after it has passed into the intestines, it oftentimes gripes.

It is tolerably certain in its operation; more so, indeed, than many other purgatives. In the proper dose, it may be given without the least hesitation to children, in any case requiring an active purge. It has an advantage over some other evacuants, that it does not stimulate or heat the system, its effect being confined, principally, to the alimentary canal—the peristaltic motion, secretions, and exhalations of which it promotes; and it is said that constipation less frequently succeeds its use than of some other purgatives.

My own experience of jalap would lead me to regard it as a perfectly safe, though active cathartic. But Dr. Christison¹ says, that “severe and even dangerous effects have followed its incautious use in the hands of the practical joker.” I am not acquainted with any cases, in the human subject, in which its employment has been attended by serious consequences. It is a more drastic purgative than senna. To scammony it is closely allied, not only by its effects, but also by botanical affinities and chemical properties. It is much less irritant to the intestinal mucous membrane than gamboge; and, therefore, is a much safer purgative. Vogt² regards it as exceeding the last-mentioned substance, but as being inferior to aloes, in its stimulant influence over the abdominal and pelvic bloodvessels; and Sundelin³ observes that, while it is more irritant, it is less heating, than aloes or senna.

USES.—Daily experience proves the value of jalap, as an active purgative, in various diseases both of children and adults. Of course, its irritant properties unfit it for exhibition in inflammatory affections of the alimentary canal, as well as after surgical operations about the abdomen and pelvis. Moreover, it is not an appropriate purgative in irritation of, or hemorrhage from, the uterus; or in piles and stricture, and prolapsus of the rectum. On the other hand, its use is indicated in torpid and overloaded conditions of the intestinal canal, as well as in constipation, attended with retention of the catamenia. When the object is to relieve cerebral congestion and dropsical affections, by a counter-irritant influence on the mucous membrane, jalap is well adapted to fulfil it, both by the energy and safety of its operation. The following are some of the cases in which it is employed:—

1. *In constipation*.—When this condition is not dependent on, or connected with, irritation or inflammation of the alimentary canal or pelvic organs, jalap is admissible. Its efficiency is much increased by association with calomel. It may be employed in febrile and inflammatory diseases (those above mentioned excepted), as well as in chronic maladies.

2. *As a vermifuge*.—The compound of jalap and calomel is a most efficacious anthelmintic, and may be used with the most happy effects in children, especially where there is an excessive secretion of mucus. “Jalap,” says Bremser,⁴ “is, without contradiction, in verminous diseases, one of the best purgatives, and which, perhaps, possesses, at the same time, greater anthelmintic virtues than any other.”

3. *In cerebral affections*.—Jalap, in combination with calomel, is used with the best effect, on the principle of counter-irritation, to relieve cerebral congestion. In inflammatory affections of the brain or its membranes, or in hydrocephalus, it is a valuable purgative.

4. *In dropsies*.—In dropsical affections it is frequently desirable to promote watery stools. Jalap, especially in combination with cream of tartar, may be used for this purpose with the best effects. Marggrave⁵ calls it a *panacea hydropicorum*.

5. *In retention of the catamenia, or of the hemorrhoidal flux*, jalap is one of the purgatives adapted, from their stimulant influence over the pelvic vessels, to promote these discharges.

ADMINISTRATION.—The dose of jalap, in powder, is, for an adult, from ten to thirty grains; a scruple usually acts smartly and safely; for children under twelve

¹ On Poisons, p. 554.

² *Handb. d. spec. Heilmittell.* Bd. ii. S. 26, 3te Aufl.

³ *Mat. Med. contr.* p. 40, ed. 2nda.

⁴ *Pharmakodyn.* Bd. ii. S. 230, 2te Aufl.

⁵ *Traité sur les Vers Intest.* p. 440.

months old the dose is from two to five grains. Fifteen grains of jalap and two or three grains of calomel, form an efficient, yet safe, purgative for an adult; but this combination very readily produces salivation by repetition. From two to five grains of ipecacuanha are sometimes substituted for the calomel. To children, jalap is sometimes exhibited in gingerbread cakes. *Purgative cakes* of this kind are kept in the shops. The *Biscuits purgatifs* (*Panes saccharati purgantes*) are composed of Jalap, ʒxx; Flour ʒij; 24 Eggs; and Sugar lbj. This quantity is sufficient for 60 biscuits.¹

1. PULVIS JALAPÆ COMPOSITUS, L. E. D. [U. S.]; *Compound Powder of Jalap*.—(Jalap ʒij [ʒij, D.]; Bitartrate of Potash ʒvj [ʒijss, D.]; Ginger ʒij [ʒss, D.]. Rub them separately to powder; then mix them, *L.* The *Edinburgh College* uses the same proportions of jalap and bitartrate of potash as the *London College*, but omits the ginger.)—[This is also the case with the *U. S. Pharm.*]—Hydragogue purgative. Used in habitual costiveness, verminous diseases, and dropsies. Dose, for an adult, ʒj to ʒj.

2. TINCTURA JALAPÆ, L. E. D. [U. S.]; *Tincture of Jalap*.—(Jalap, bruised, ʒv [in moderately fine powder, ʒvij, E.]; Proof Spirit Oij [Oiss, D.]. Macerate for seven [fourteen, D.] days, and strain, *L. D.* [The *U. S. Pharm.* directs Jalap, in powder, six ounces; Diluted Alcohol two pints. Macerate for fourteen days, express and filter through paper.] “This tincture may be prepared either by digestion or percolation, as directed for tincture of cinchona,” *E.*)—An active cathartic. Rarely used alone; generally employed as an adjunct to purgative draughts, the activity of which it promotes.—Dose, fʒj to fʒiv. As an adjuvant to a cathartic draught, the dose rarely exceeds fʒij.

3. EXTRACTUM JALAPÆ, L. [U. S.]; *Extractum sive Resina Jalapæ*, E.; *Extract of Jalap*.—(Jalap Root, powdered, lbiss. [lbj, U. S.]; Rectified Spirit Cong. j [Oiv, U. S.]; Distilled Water Cong. ij [a sufficient quantity, U. S.]. Macerate the jalap root in the spirit for four days, and pour off the tincture. Boil down the residue in the water to half a gallon; afterwards strain the tincture and the decoction separately, and let the latter be evaporated, and the former distil, until each thickens. Lastly, mix the extract with the resin, and evaporate to a proper consistence, *L.* This extract should be kept *soft*, which may be fit to form pills, and *hard*, which may be rubbed to powder, *L.* The directions of the *Edinburgh College* are the following: “Take any convenient quantity of jalap, in moderately fine powder; mix it thoroughly with enough of the rectified spirit to moisten it well; put it in twelve hours into a percolator, and exhaust the powder with rectified spirit; distil off the greater part of the spirit, and concentrate the residuum over the vapour-bath to a due consistence.”)—In this process, the alcohol extracts the resin, and the water subsequently used by the *London College* takes up the gummy extractive; the alcoholic tincture is distilled to save the spirit, while the aqueous decoction is evaporated. The preparation of the *Edinburgh College* is the impure resin of jalap; whereas, that of the *London College* is a mixture of resin with the gummy extractive. It was formerly, and indeed is now by many persons, supposed, that the combination of these ingredients was necessary for the full cathartic effect of jalap. It is, however, well known that the watery extract is inert as a purgative, though it is said to be diuretic; the only advantage, therefore, that can attend the mixture of the two extracts (the watery and the alcoholic), is, that the resin is intimately divided, and thereby prevented from causing violent irritation and griping in any one part of the intestinal tube. But it is obvious that the same advantage can be obtained by mixing the resin with some mild agent (as almonds, sugar or saline matter, as sulphate of potash). Mr. Brande² says, that jalap yields about 66 *per cent.* of extract; that is, 16 of alcoholic, and 50 of watery extract. According to this statement, therefore, the extract of the *Edinburgh Col-*

¹ Jourdan, *Pharmacopée Universelle*.

² *Dict. Mat. Med.* p. 331.

lege possesses four times the activity of that of the London College. The dose of the *resin* (Ph. Ed.) is from grs. iij to grs. vj, in a minute state of division, as above directed; of the extract, *Ph. L.*, from grs. x to ʒj.

183. *Pharbitis Nil*, Choisy.

Sex. Syst. Pentandria, Monogynia.

(Semina.)

Convolvulus Nil, Linn.—A tropical plant, with purgative seeds.—The *Pharbitis Cærulea*, Wallich (*Ipomæa cærulea*, Koenig, in Roxb. Fl. Ind., vol. i. p. 501), is probably only a variety of it. Its seeds are sold in India under the name of *kala dana*, *hub ul nil*, and *mirchai*. They are black, angular, and weigh on an average half a grain each. Their taste is sweetish, and subsequently acrid. They consist of resin, gum, starch, bland fixed oil, vegetable fibre, and colouring matter. They yield from 15 to 20 per cent. of alcoholic brown extract containing resin and oil. In doses of from 30 to 40 grains the seeds act as a quick and safe cathartic; in some few cases they occasion vomiting and griping. The alcoholic extract may be given in doses of ten grains. The effects of the seeds and extract resemble those of jalap, for which they may be substituted.¹ Roxburgh directs the seeds to be gently roasted like coffee, then powdered, and given in any convenient vehicle.

ORDER XLV. GENTIANACEÆ, Lindley.—GENTIANWORTS.

GENTIANEÆ, Jussieu.

CHARACTERS.—*Calyx* divided, inferior, persistent. *Corolla* monopetalous, hypogynous, usually regular and persistent; the limb regular, sometimes furnished with delicate fringes, its lobes of the same number as those of the calyx, generally 5, sometimes 4, 6, 8, or 10; occasionally, extended at the base into a bag or spur, with a plaited, or folded, or imbricated twisted aestivation. *Stamens* inserted upon the corolla; all in the same line, equal in number to the segments, and alternate with them; some of them occasionally abortive. *Ovary* composed of 2 carpels, 1- or partly 2-celled, many-seeded. *Style* 1, continuous with the ovary; *stigmas* 2, right and left of the axis; *ovules* indefinite, anatropal, parietal; *capsule* or *berry*, many-seeded; when two-valved, the margins of the valves turned inwards, and bearing the seeds; in the two-celled genera inserted into a central placenta. *Seeds* small; *testa* single; *embryo* minute in the axis of soft fleshy *albumen*; *radicle* next the hilum.—*Herbaceous* plants, seldom *shrubs*, generally smooth, sometimes twining. *Leaves* opposite, entire, without stipules, sessile, or having their petioles confluent in a little sheath, in most cases 3—5 ribbed; very rarely brown and scale-like; sometimes alternate. *Flowers* terminal or axillary, regular or very seldom irregular. (Lindley.)

PROPERTIES.—This order contains a bitter principle, which is especially abundant in the roots. On this substance depends the stomachic, tonic, and febrifuge properties of the different species.

184. *GENTIANA LUTEA*, Linn.—COMMON OR YELLOW GENTIAN.

Sex. Syst. Pentandria, Digynia.

(*Radix, L.*—Root, *E. D.*)

HISTORY.—Gentian is said to owe its name and introduction into medical use to Gentius, king of Illyria, who was vanquished by the Romans about 160 or 169 years before Christ. It is, therefore, not noticed by either Hippocrates or Theophrastus, but is mentioned by Dioscorides,² who calls it *γεντιανή*; and by Pliny.³

BOTANY. Gen. Char.—*Calyx* 5—4-parted or split, sometimes dimidiate-spathaceous, valvate. *Corolla* withering, rarely glandular, without epipetalous hollows; the limb 5—4-parted, or spuriously 10-parted. *Stamens* 5—4, inserted in the tube of the corolla; filaments equal at the base. *Ovary* 1-celled; the ovules in rows next the suture. *Stigmas* 2, terminal, revolute, or, if contiguous, funnel-shaped; *style* 0, or persistent with the stigmas. *Capsule* 2-valved, septicidal, 1-celled: the placentæ membranous. *Seeds* immersed in the placentæ. (Condensed from Grisebach.)

¹ O'Shaughnessy, *Bengal Dispensatory*.

² *Hist. Nat. lib. xxv. cap. 34, ed. Vulp.*

³ *Lib. iii. cap. 3.*

Sp. Char.—Stem tall, straight. Leaves oval and ovate, smooth at the margin. Cymes umbelliform, dense-flowered, axillary or terminal, pedunculate. Corollas yellow; the segments oblong-linear, acuminate (Grisebach).

Root perennial, cylindrical or spindle-shaped, simple or somewhat branched, ringed, wrinkled, externally brown, internally yellow and fleshy. **Stem** simple, erect, 2—3 feet high, roundish, hollow, smooth. **Leaves**, pale green, opposite, ovate or oval, pointed, entire, smooth, 5—7-ribbed, plaited; lower ones on short, sheathing petioles; upper ones amplexicaul; those next the flowers becoming concave yellowish-green bracts. **Flowers** on smooth peduncles of 4—6 lines long. **Calyx** yellow; **Corolla** yellow; segments 5—7, lanceolate. **Stamens** as long as the corolla. **Ovary** conical, with 5 greenish glands at the base. **Capsule** conical, 2-valved. **Seeds** numerous, roundish, albuminous, with membranous margins.

Hab.—Subalpine and mountainous meadow, 6500—3000 feet above the level of the sea, of Central and Southern Europe.

COLLECTION.—The roots are collected and dried by the peasants of Switzerland, the Tyrol, Burgogne, and Auvergne. They are imported into this country in bales from Havre, Marseilles, &c.

DESCRIPTION.—Gentian root (*radix gentianæ*) is imported in cylindrical, usually more or less branched pieces, varying in length from a few inches to a foot or more, and in thickness from half an inch to one or two inches. These pieces are marked by transverse annular wrinkles and longitudinal furrows. Externally the root is yellowish-brown, internally it is brownish-yellow; its texture is spongy; its odour, in the fresh state, peculiar and disagreeable; its taste is intensely bitter. The root of other species of *Gentiana* are said to be frequently mixed with those of the official species; their effects, however, are analogous.

Martius¹ says, that the roots of *G. Purpurea* have strong longitudinal furrows, and are of a darker brown colour internally, but want the transverse wrinkles. The roots of *G. pannonica* are similar to those of *purpurea*. Both kinds are met with in Bavaria, and serve in Switzerland for the preparation of a spirit. *Gentiana punctata* has roots which are just as bitter, but of a more yellow colour; they are dug up in great abundance in Moravia. The roots of both the last-mentioned species are dug up at, and exported from, Salzburg; in the fresh state they are white when sliced.

CHEMISTRY.—Gentian root was analyzed, in 1815, by Schrader;² in 1817 by Braconnot;³ in 1818 by Henry;⁴ in the same year by Guillemin and Fœquemine;⁵ and in 1821 by Henry and Caventou.⁶ In 1837 it was examined by Leconte.⁷ The constituents of gentian root, according to Henry and Caventou, are—a volatile odorous matter, bitter crystalline matter (*gentianin*), fugaceous odorous principle (volatile oil?), yellow colouring matter, green fixed oil, gum, uncrystallizable sugar, matter identical with bird-lime, a free organic acid, and woody fibre. But in 1837, H. Trommsdorff⁸ and Leconte⁹ showed that, under the name of gentianin, two substances had been confounded—the one crystalline and tasteless; the other bitter. The first has been called *gentisin*; the second *gentianite*. Furthermore, Leconte has shown that the substance considered by Henry and Caventou as identical with bird-lime, is a compound of wax oil and caoutchouc.

1. **OIL OF GENTIAN.**—By distillation with water, gentian root yields a very small quantity of a butyraceous oil, which floats on water, has a powerful odour of gentian root, and is soluble in alcohol. A few drops of the melted oil were given to a rabbit, without causing any remarkable effects. I have received from Mr. Whipple two samples of this oil, the one green, the other white like mutton fat. Three *cwt.* of the root yielded only about 3*ss.* of oil.

Planche¹⁰ states, the distilled water of gentian caused nausea and a kind of intoxication.

2. **GENTISIN, OR GENTISIC ACID.**—Procured by washing the alcoholic extract of the root

¹ *Pharmakognosie*.

² *Journ. de Physiq.* lxxxiv. 345.

³ *Ibid.* p. 110.

⁴ *Ibid.* t. xxii. p. 465.

⁵ *Op. supra cit.*

⁶ Trommsdorff's *N. Journ.* Bd. iii. S. 251.

⁷ *Journ. de Pharm.* t. v. p. 97.

⁸ *Ibid.* t. vii. p. 173.

⁹ *Berlin. Jahrbuch.* Bd. xxxvii. S. 182.

¹⁰ *Bull. de Pharmacie*, t. vi. p. 551.

with water, and then treating with alcohol. The tincture obtained was evaporated, the extract treated by ether; the residue, by successive solutions and evaporations, yielded gentisin. It is pale yellow, crystallizable in needles, has a peculiar but weak smell. When cautiously heated, it gives out some yellow vapours, which are condensed on the upper part of the tube. It is scarcely soluble in water, but dissolves in alcohol. With alkalis, it unites to form salts. Its saturating power is about 438. Trommsdorff says, that a solution of gentisic acid is unaffected by acetate of lead, nitrate of silver, and most other tests. Chloride of iron and the salts of copper produced, in the alcoholic solution, the most characteristic changes.

3. BITTER PRINCIPLE OF GENTIAN (*Gentianite*).—This has not hitherto been isolated. By digesting the alcoholic extract of gentian in water, an acidulous intensely bitter solution is obtained. The acid may be thrown down by lead. When the excess of lead has been removed from the solution by sulphuretted hydrogen, a liquid is obtained, which, by evaporation, yields a sweet and very bitter extract, from which ether removes an aromatic fat, an odorous resin, and wax. The bitter matter has not been separated from the sugar.

4. PECTIN.—The existence of pectic acid (pectin) in gentian, was ascertained, in 1835, by Denis.¹ To this substance is to be in part, perhaps, ascribed the gelatinization of infusion of gentian, which, under certain circumstances, is not unfrequently observed.

5. SUGAR.—To the presence of this matter in gentian is to be ascribed the capability of the infusion of gentian to undergo the vinous fermentation, and to form an alcoholic liquor (*gentian spirit*), much admired by the Swiss.²

CHEMICAL CHARACTERISTICS.—The infusion of gentian is deepened in colour by the caustic alkalis. Sesquichloride of iron communicates a deep olive-brown tint. The acetate and diacetate of lead, the sulphate of copper, and the nitrate of mercury, cause flocculent or gelatinous precipitates (*metallic pectates?*).

PHYSIOLOGICAL EFFECTS.—Gentian is very properly regarded as a *pure or simple bitter*; that is, as being bitter, but without possessing either astringency or much aroma. It has, therefore, the usual tonic properties of medicines of this class, which I have before noticed (see vol. i. p. 244).

Given in full doses, it appears more disposed to relax the bowels than the other simple bitters, and, in susceptible individuals, it is more apt to disorder the digestive process. In such cases, both Loseke and Voigtel³ have seen it cause vomiting. Barbier⁴ says it quickens the pulse. It is somewhat less bitter, and therefore, I presume, somewhat less powerful, than quassia.

By continued use, the sweat and urine acquire a bitter taste;⁵ a sufficient proof that gentian, or its bitter principle, becomes absorbed.

As some of the vegetable bitter tonics (for example, quassia and calumba) have been found to exert a specific influence over the cerebro-spinal system, and to yield preparations of a poisonous quality, we are naturally led to inquire whether any analogous facts have been made out with respect to gentian. The reply is in the affirmative. Magendie,⁶ indeed, discovered no poisonous operation in *Gentianin*; he threw several grains of this principle into the veins of an animal, without any obvious effect, and swallowed two grains, dissolved in alcohol, but only observed extreme bitterness, and a slight feeling of heat in the stomach. Moreover, Hartl⁷ inserted two grains of the extract of gentian into the inner side of the thigh of a rabbit, without any ill effects resulting; the wound was slightly inflamed, though it soon healed. These facts prove, that the bitter extractive of gentian possesses no narcotic properties. But if the narcotic principle of gentian be of a volatile nature, these experiments of Magendie and Hartl⁸ go for nothing, since, in the preparation of both the extract and the *gentianin*, this principle would be dissipated by the heat employed. Now, Planché⁹ has shown, as I have already mentioned, that the distilled water of gentian causes violent nausea, and, within three minutes, a kind of intoxication. Moreover, Buchner¹⁰ tells us that, some years ago, a narcotic effect was produced in Prussia, by the medicinal use of gentian root, although the presence of any foreign matter could not be detected. In the *Philosophical Transac-*

¹ *Journ. de Pharm.* t. xxii. p. 303.

² Bawald, in *Pratt's Mat. Med.* Bd. ii. S. 29; and Planché, *Bull. de Pharm.* vi. 551.

³ *Arzneimittell.* Bd. ii. S. 359.

⁴ *Mat. Med.*

⁵ *Arzneimitt.* Prakt. *Arzneimittell.* S. 188, 6te Aufl.

⁶ *Essai* p. 313, 5me edit.

⁷ Quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. ii. S. 308.

⁸ *Ibid.*

⁹ *Op. cit.*

¹⁰ *Toxikol.* S. 192.

tions for the year 1748, are mentioned some deleterious effects, resulting from the use of gentian; but they were referred to a foreign root, said to have been intermixed with, and which greatly resembled, the true gentian root.

All these facts, then, support the opinion of Haller (quoted by Buchner), that gentian is not so innocuous as is generally supposed.

USES.—Gentian is adapted to most of the cases requiring the use of the pure or simple bitters (see vol. i. p. 244). It agrees best with phlegmatic, torpid individuals, and is apt to disagree with irritable or susceptible persons. It is contraindicated in febrile disorders and inflammatory conditions of the gastro-intestinal membrane. It is employed principally in the following cases:—

1. In *dyspepsia*, and other gastric disorders, attended with debility or torpidity, and unaccompanied by any marks of inflammation or irritation, or great susceptibility, of the digestive organs. Sesquicarbonate of ammonia is a very valuable adjunct.

2. In *intermittent diseases* it may be used where cinchona is admissible; but it is much inferior to the last-mentioned substance. "Joined with galls or tormentil, in equal parts, and given in sufficient quantity, it has not failed," says Dr. Cullen,¹ "in any intermittents in which I have tried it."

3. In many other diseases marked by weakness and debility, but unattended by fever or gastro-intestinal irritation, gentian is admissible and useful; as in some forms of gout, hysteria, uterine disorders, &c. It is a constituent of the *Duke of Portland's powder for the gout* (see ante, p. 387).

4. Against worms, it has been used as if it possessed some specific influence.

5. In surgery, it has been used for discutient fomentations, also in the form of fine powder, as an application to issues, to promote their running, and as a tent, to enlarge and cleanse fistulous apertures.²

ADMINISTRATION.—In the form of *powder*, the dose is from grs. x to ʒss. But the *infusion*, *tincture*, or *extract*, are the usual forms of exhibition.

1. INFUSUM GENTIANÆ COMPOSITUM, L. D. [U. S.]; *Infusum Gentianæ*, E.; *Infusion of Gentian*; [*Compound Infusion of Gentian*, U. S.]—(Gentian Root, sliced, ʒij; Orange Peel, dried, ʒij [Lemon Peel, fresh, ʒiv, L.]; Boiling [Distilled, L.] Water Oj [Oss, D.]; Macerate for an hour in a vessel lightly covered, and strain. The directions of the *Edinburgh College* are as follows: Gentian, sliced, ʒss; Bitter Orange Peel, dried and bruised, ʒj; Coriander, bruised, ʒj; Proof Spirit fʒiv; Cold Water fʒxvj [fʒxij, U. S.]. Pour the spirit upon the solids; in three hours add the water, and in twelve hours more strain through linen or calico.)—The infusion of the London and Dublin Pharmacopœias is very apt to spoil by keeping; but as it can always be speedily procured, this is not a circumstance of much importance. However, to obviate it as much as possible, the Edinburgh College orders cold water to be used (by which less of the mucilaginous matter [pectin, &c.] is dissolved), and employs spirit to promote the solution of the bitter principle, while the quantity of gentian is much increased; so that, in fact, we have a weak tincture, rather than an infusion. Besides the objections which may arise out of these deviations, a very important one is the length of time required for the maceration.

Compound infusion of gentian sometimes gelatinizes by keeping. This occurred in one case³ when the infusion instead of being strained off in an hour had been allowed to stand forty-eight hours, and liquor potassæ had been added to it. Though this perhaps may be in part due to the action of the alkali on the pectin contained in the gentian, it is chiefly, if not entirely, owing to the action of the alkali on some principle extracted by prolonged maceration from the lemon-peel⁴ (see *cortex limonum*).

Infusion of gentian is stomachic and tonic. When prepared according to the London and Dublin Pharmacopœias, the dose is fʒj to fʒij; when according to that of the Edinburgh, fʒss to fʒj.

¹ *Mat. Med.* vol. ii. p. 72.

² Fordred, *Pharmaceutical Journal*, vol. i. p. 229. 1841.

³ Quincy, *Dispens.*

⁴ *Ibid.* vol. i. p. 527. 1841.

2. **MISTURA GENTIANÆ COMPOSITA**, L.; *Compound Mixture of Gentian*.—(Compound Infusion of Gentian f3xij; Compound Infusion of Senna f3vj; Compound Tincture of Cardamoms f3ij. Mix).—Tonic and cathartic. Used in dyspepsia with constipation.—Dose, f3j to f3ij.

3. **TINCTURA GENTIANÆ COMPOSITA**, L. E. D. [U. S.]; *Tinctura amara*; *Tincture of Gentian*.—(Gentian, sliced and bruised, 3iiss [3iij, D.]; Orange Peel, dried, 3x [3iiss, D.]; Cardamom [seeds], bruised, 3v [3ss, D.]; Proof Spirit Oij. Macerate for seven [fourteen, D.] days, express and strain, L. D. The *Edinburgh College* employs of Gentian, sliced and bruised, 3ijss; Dried Bitter Orange Peel, bruised, 3x; Canella, in moderately fine powder, 3vj; Cochineal, bruised, 3ss; and Proof Spirit, Oij. [The *U. S. Pharm.* directs Gentian, bruised, 3ij; Orange Peel 3i; Cardamom, bruised, 3ss; Diluted Alcohol Oij. Macerate for fourteen days, express, and filter through paper; or it may be prepared by displacement.] This tincture may be more conveniently prepared by percolation, as directed for the compound tincture of cardamom, E.)—A grateful cordial tonic and stomachic. Employed as an adjunct to the infusion, effervescing draughts, bottle soda-water, &c.—Dose, f3ss to f3ij.

4. **VINUM GENTIANÆ**, E.; *Wine of Gentian*.—(Gentian, in coarse powder, 3ss; Yellow Bark, in coarse powder, 3j; Bitter Orange Peel, dried and sliced, 3ij; Canella, in coarse powder, 3j; Proof Spirit f3ivss; Sherry Oj and f3xvj. Digest the root and barks for twenty-four hours in the spirit; add the wine, and digest for seven days more; strain and express the residuum strongly, and filter the liquors.)—Wine of gentian is an aromatic tonic, useful in dyspepsia and anorexia. It is apt to become acetous by keeping.—The dose of it is f3ss to f3j.

5. **EXTRACTUM GENTIANÆ**, L. E. D. [U. S.]; *Extract of Gentian*.—(Gentian, sliced, 1buj; Boiling Distilled Water Ovj. Macerate for twelve hours in four pints of the water; pour off the liquor and strain it. Add two pints of the water to the residue, macerate for six hours, lightly express the liquor and strain. Lastly, evaporate the mixed liquors to a proper consistence, L. "Take of Gentian, any convenient quantity; bruise it to a moderately fine powder; mix it thoroughly with half its weight of distilled water; in twelve hours put it into a proper percolator, and exhaust it by percolation with temperate distilled water; concentrate the liquid, filter before it becomes too thick, and evaporate in the water-bath to a due consistence," E. Gentian Root, in thin slices, 1buj; Distilled Water Oijj. Macerate the gentian in one pint and a half of the water for six hours, then strain and express. Add to the residue the remaining pint and a half of water, macerate again for six hours, strain, and express. Finally, mix the liquors, and evaporate by a steam or water-bath to a proper consistence, D.—[Gentian, in coarse powder, 1buj; Water, a sufficient quantity. Mix with a pint of water; allow to stand for twenty-four hours; and then displace until the bitterness of the gentian is exhausted. Evaporate to the proper consistence, U. S.]—Good gentian root yields, by the process of the *London Pharmacopæia*, about half its weight of extract.¹ Extract of Gentian is tonic. It is usually employed as a vehicle for the exhibition of the metallic substances (especially chalybeates) in the form of pill.—Dose, grs. x to 5ss.

185. OPHELIA CHIRAYTA, Griseb. — THE CHIRETTA OR CHIRAYTA.

Agathotes Chirayta, Don.² E. D.—*Gentiana Chirayita*, Fleming.

Succ. Syst. Tetrandria, Monogynia.

(Herb, D. and Root, E. The Herb, D.)

HISTORY.—This plant seems to have been long in use among the natives of India. Professor Guibourt³ thinks that it is the *χαλαμος ἀρωματικός* of Dioscorides⁴

¹ Brando, *Dict. of Mat. Med.* p. 261.

² *Journ. de Chim. Méd.* t. i. p. 229.

³ *Transactions of the Linnean Society*, vol. xvii. p. 522.

⁴ Lib. i. cap. 17.

(see *ante*, p. 154). Various circumstances, however, appear to me to be opposed to this opinion; one of the most conclusive is the absence of odour in the chirayta plant.¹

BOTANY. **Gen. Char.**—*Calyx* 5—4-parted; the segments valvate. *Corolla* withering, rotate, 5—4-parted, with glandular pits above the base. *Stamens* 5—4, inserted in the throat of the corolla; the filaments either dilated at the base and monodelphous, or equal at the base and free. *Ovary* 1-celled; ovules numerous, inserted on the suture. *Stigmas* 2, terminal, short, usually revolute; *style* 0, or short. *Capsule* 2-valved, septicial, 1-celled; placentæ either spongy and sutural, or expanded near the suture. *Seeds* immersed in the placentæ, very numerous, small, and generally wingless (Grisebach).

Sp. Char.—Stem terete, tall, smooth, branched. Branches elongated, erect-spreading. Leaves cordate-ovate, and ovate, acuminate, sessile, smooth, 5—7-nerved. Cymes umbelliform, lax, few-flowered. Segments of the calyx sublanceolate, acuminate, shorter than the corolla, corollæ 4-parted, yellow, the segments expanded, ovate-lanceolate, acuminate; pits in pairs, oblong, distinct, fringed anteriorly by long scales; the fringes epipetalous, short, connecting the pits. (Grisebach.)

Herbaceous. *Root* branching. *Stem* round, jointed. *Leaves* opposite amplexicaul, very acute, entire. *Flowers* numerous, peduncled.

Hab.—Mountains of Nepal and the Morungs.

DESCRIPTION.—The plant is pulled up by the root, about the time that the flowers begin to decay and the capsules are well formed.² The dried plant, with the root (*herba et radix chirettæ* sive *chiraytæ*) is met with in the shops. The root is fibrous; the stem is round, smooth, not jointed, marked with the cicatrices of leaves, has a yellowish pith; the leaves are as above described. The whole plant is without odour, but has an intensely bitter taste.

COMPOSITION.—The stems of this plant were analyzed by MM. Lassaigne and Boissel,³ who obtained the following results: *resin, yellow bitter matter, brown colouring matter, gum, malic acid* [woolly fibre], *malate of potash, chloride of potassium, sulphate of potash, phosphate of lime, silica, and traces of oxide of iron.*

The BITTER MATTER is the most important constituent. No vegetable alkali has been detected in it. The substance which was sold as *sulphate of Chiraytine* was sulphate of quinia.⁴

PHYSIOLOGICAL EFFECTS.—Chirayta is an intensely bitter substance, and produces the before-described (see vol. i. p. 244) effects of the *simple or pure bitters*. In its operation, as well as by its botanical affinities, it is closely allied to gentian. It appears to possess rather a relaxing than a constipating effect.⁵

USES.—It has long been employed by the natives of India in the same class of cases in which gentian has been used in Europe. As a stomachic it is especially serviceable in the dyspepsia of gouty subjects. It strengthens the stomach, obviates flatulency, and diminishes the tendency to acidity.⁶ Combined with the seeds of *Guilandina Bonduc* it is employed with success in intermittents.⁷

ADMINISTRATION.—It may be given in *powder*, in the dose of ℥j, or it may be employed in the form of *infusion, tincture* (prepared with cardamom and orange peel, like *compound tincture of gentian*), or *extract*.

1. **INFUSUM CHIRETTÆ, E. D.;** *Infusion of Chiretta*.—(Chiretta ℥iv [℥ij, D.]: Boiling Water Oj [℥ixss, D.]. Infuse for two hours, and strain through linen or calico).—The dose of this is ℥j to f℥ij.

2. **TINCTURA CHIRETTÆ, D.;** *Tincture of Chiretta*.—(Chiretta, bruised, ℥v; Proof Spirit Oij. Macerate for fourteen days, strain, express, and filter, D.)—Dose, ℥j to ℥iv.

¹ Fée, *Cours d'Hist. Nat.* t. ii. p. 395.

² *Journ. Pharm.* vol. vii. p. 283.

³ Baker, *Lond. Med. Gaz.* vol. ii. p. 685.

⁴ Johnson, *Infl. of Trop. Climates*, 3d edit. p. 58.

⁵ Roxburgh, *Fl. Ind.* vol. ii. p. 72.

⁶ *Lond. Med. Gaz.* vol. xxi. 173.

⁷ Fleming, *Asiat. Researches*, vol. xi. p. 167.

186. *Erythræa Centaurium*, Persoon.—Common Centaury.

Sex. Syst. Pentandria, Monogynia.

(Centaurium, L.—The flowering heads, E.—Folia, D.)

HISTORY—This plant was known to the ancients, and received one of its names (*Chironia Centaurium*) from Chiron the Centaur, who is said to have lived 1270 years before Christ. But the plant which Pliny¹ says cured Chiron of a wound received by an arrow, which he dropped on his foot when examining the arms of Hercules, is supposed to be the *Centaurea Centaurium*.

BOTANY. **Gen. Char.**—*Calyx* 5—4 partite, the segments nearly flat, wingless. *Corolla* funnel shaped, naked, contorted withering above the capsule; the tube cylindrical; the limb 5—4-partite. *Stamens* 5—4, inserted above in the tube of the corolla; anthers erect, twisted spirally, exserted. *Ovary* 1 celled or semi 2-celled in consequence of the valves being slightly inflexed. The ovules inserted at the suture. *Style* distinct, deciduous; *stigma* bilamellate or undivided and capitate. *Capsule* bivalved, septiceid, 1-celled or semi-2 celled; the placenta spongy and sutural. *Seeds* immersed in the placenta; sub-globose, smooth, minute (Grisebach).

Sp. Char.—Stem erect, elongated, branched superiorly. Leaves elliptic-oblong, unequally acute. Flowers collected in loose heads, lateral, bibracteate. Tube of the corolla during inflorescence more than twice the length of the calyx, the tubes oval and obtuse. Capsule with the valves much inflexed, more than semi-2-celled (Grisebach).

Root small, tapering. *Stem* about a foot high, leafy. *Radiate leaves* obovate; the rest acute, ovate, or elliptic-lanceolate; all 3-ribbed, bright green. *Flowers* nearly sessile. *Bracts* opposite, awl-shaped. *Calyx* slender. Tube of *corolla* pale-greenish; limb brilliant pink, expanded only in sunshine, closing as soon as gathered.

Hab.—Indigenous; dry gravelly pastures. Annual. Flowers in July and August.

DESCRIPTION—The herb or tops (*herba seu summitates vel cacumina centaurii minoris*) of the common or lesser centaury are without odour, but have a very bitter taste. They are collected when in flower.

COMPOSITION—According to Moretti,² common centaury contains *bitter extractive, free acid, mucous matter, extractive salts* [and *woody fibre*].

The principal constituent of common centaury is the bitter extractive, called by Dulong d'Astafort³ *centaurin*. This, when combined with hydrochloric acid, is said to be an excellent febrifuge. Centaurin must not be confounded with *centauride*, the bitter principle of *Cnicus benedictus*, De Cand.

PHYSIOLOGICAL EFFECTS.—Similar to those of gentian (see *ante*, p. 525), and of other simple or pure bitters (see *ante*, p. 244).

USES.—Common or lesser centaury is rarely used by medical practitioners; yet it might be employed as an indigenous substitute for gentian. Dose of the powder, ℞j to ʒj. It may also be used in infusion.

187. *Menyanthes trifoliata*, Linn.—Common Buckbean; Marsh Trefoil.

Sex. Syst. Pentandria, Monogynia.

(Menyanthes, L.—Leaves, E.—Folia, D.)

HISTORY—Sprengel⁴ considers this to be the plant referred to by Theophrastus⁵ under the name of *μηνανθος*.

BOTANY. **Gen. Char.**—*Calyx* 5-partite, the segments connected at the base, so as to form a tube. *Corolla* deciduous, funnel-shaped, fleshy; the limb 5-partite, its segments naked at the margin and base, but fringed or very rarely denuded at the disk, no epipetalous glands. *Stamens* 5, inserted in the tube of the corolla; filaments equal at the base; anthers erect. *Ovary* surrounded by 5 hypogynous glands, 1-celled; the ovules inserted on the axis of the valves. *Style* filiform, persistent with the 2 lobed stigma. *Capsule* 1-celled, almost valveless, rupturing near the suture of the two carpella; the placenta inserted in the axis of the carpella. *Seeds* indefinite, with a shining very smooth testa. (Grisebach.)

Sp. Char.—The only species.

Rhizoma black, creeping, jointed. *Leaves* on long stalks, with broad sheathing stipules at base, ternate; leaflets nearly oval, smooth. *Scape* round, ascending, smooth. *Bracts* ovate. *Calyx* obtuse. *Corolla* white, or flesh coloured, elegant, densely shaggy. *Anthers* yellow.

Hab.—Indigenous; watery meadows, ditches, &c.; frequently cultivated in ornamental grounds, on account of the beauty of the flowers. Perennial. Flowers in June and July.

¹ Hist. Nat. lib. xxv. cap. 30, ed. Valp.² Ibid. t. xvi. p. 502.³ Hist. Plant. lib. iv. cap. 11.⁴ Journ. de Pharm. t. v. p. 98.⁵ Hist. Ret. Herb. t. i. p. 82.

DESCRIPTION.—The whole herb (*herba menyanthis* seu *trifolii fibrini*) is odourless, but has a very bitter taste. Its infusion strikes a green colour (*tannate of iron*) with the sesquichloride of iron. The leaves (*folia menyanthis*) are the parts usually employed.

COMPOSITION.—Menyanthes was analyzed by Trommsdorff,¹ who found that the fresh plant consists of 75 parts of moisture, and 25 of solid matter, composed of *bitter extractive*, *vegetable albumen*, *green resin* (*chlorophylle*), *peculiar matter* precipitable by tannic acid, but soluble in water and in weak spirit, *brown gum*, *fecula* (*inulin* or *menyanthin*), *malic acid*, and *acetate of potash*.

The *bitter extractive* is the active principle. Brandes states that he procured a white bitter powder from menyanthies; but B. Trommsdorff² repeated Brandes's experiments, and procured only a yellowish-brown bitter extract.

PHYSIOLOGICAL EFFECTS.—Tonic and astringent. In large doses cathartic, and sometimes emetic.

USES.—This plant is used by the brewers of some parts of Germany, particularly Silesia and the adjacent provinces, as a substitute for hops.³ It is rarely employed in medicine, but is applicable for the same purposes as the other bitter tonics (see *ante*, p. 244). It has been esteemed efficacious as an antiscorbutic.⁴

ADMINISTRATION.—It may be given in *powder*, *infusion*, or *extract*.—The dose of the powder is from ℞j to ℥ss; if given to the extent of ℥j, it generally purges. The dose of the *infusion* (prepared with ℥ss of the dried herb, and f℥xvj of boiling water) is f℥j to f℥ij; of the *watery extract*, grs. x to grs. xv.

188. *Frasera carolinensis*, Walter.

Sex. Syst. Tetrandria, Monogynia.

(Radix.)

Frasera carolinensis, Walter, Fl. Carol. 1788; *F. Walleri*, Michaux, Fl. Boreali-Americ. 1803; *American Calumba*.—A native of the southern and western portions of the United States, and very abundant in Arkansas and Missouri. The root is officinal in the Pharmacopœia of the United States. As met with in commerce, it is in transverse circular segments, about an inch in diameter, and an eighth of an inch, or more, in thickness. It contains no starch, and hence undergoes no change of colour when touched with iodine. Its infusion or decoction becomes blackish green (*tannate of iron*) when treated with sulphate of iron, and lets fall a precipitate (*tannate of gelatin*) on the addition of a solution of isinglass. The effects, uses, and doses of *Frasera* are the same as those of gentian. The fresh root is said to operate as an emetic and cathartic.⁵ Some years ago, it was introduced into France, and sold for calumba; hence, it got the name of *false calumba*. The chemical characters above given, as well as the physical properties of the root, readily distinguish it.⁶

ORDER XLVI. LOGANIACEÆ, De Cand.—LOGANIADS.

CHARACTERS.—*Calyx* free, 5- rarely 4-lobed. *Corolla* regular or rarely irregular, hypogynous, 5- rarely 4- or many-lobed, æstivation valvate, contorted, or imbricated. *Stamens* inserted in the tube of the corolla; anthers 2-celled, dehiscing longitudinally; pollen vittate-trilobed. *Ovary* free (superior), 2- rarely 3-celled or 1-celled; ovules amphitropal, or rarely anatropal. *Style* simple; *stigma* simple or 2-lobed. *Fruit* capsular or drupaceobaccate. *Seeds* usually peltate, sometimes winged; albumen fleshy or cartilaginous; embryo straight; radicle towards or parallel with the hilum; cotyledons 2, foliaceous.—*Shrubs, trees, or rarely herbs. Leaves* opposite, entire, stalked, usually with stipules. *Flowers* racemose or corymbose, rarely solitary.

PROPERTIES.—Poisonous (with some exceptions); acting on the nervous system. This order contains some of the most energetic vegetable poisons. *Strychnia* and *brucia* are produced by some of the species, which in consequence excite most frightful convulsions.—The medicinal species of this order are used as spastics (see *ante*, p. 245), anthelmintics, and tonics.

189. *SPIGELIA MARILANDICA*, Linn.—CAROLINA PINK; PERENNIAL WORMGRASS.

Sex. Syst. Pentandria, Monogynia.

(Root, E.)

HISTORY.—The anthelmintic virtues of this plant were first learned from the Cherokee Indians, who became acquainted with them, according to Dr. Garden, about 1723; they were made known to the profession about 1740.⁷

¹ *Ann. de Chim.* t. lxxii. p. 191.

² *Yossy, Origin and Progress of the Med. Bot. Soc.* p. 12.

³ *United States Dispensatory.*

⁴ *Essays and Obs. Phys. and Lit.* vol. iii.

⁵ *Pharm. Central-Blatt für 1832*, p. 459.

⁶ *Murray, App. Med.* t. ii. p. 31.

⁷ *Guibourt, Journ. de Chim. Méd.* t. ii. p. 334.

BOTANY. Gen. Char.—*Calyx* 5-partite, persistent; the segments linear-subulate, glandular. *Corolla* gamopetalous, funnel-shaped; the lobes 5, shorter than the tube, with a valvate æstivation. *Stamens* 5, inserted on the tube of the corolla, inclosed or rarely exerted; filaments slender; anthers linear, erect, 2-lobed at the base. *Ovary* 2-celled; ovules numerous, amphitropal; placentæ basilar, stipitate. *Style* filiform, hairy above, jointed beneath the capitate or concave stigma. *Capsule* obovoid-compressed, didymous, dioecious, circumscissile at the base; the cocci at length bi-partite. *Seeds* few, cuneate-turbinate; the testa scabrous-areolate; the embryo at the base of horny albumen, small, straight. (De Cand.)

Sp. Char.—Stem erect, simple, quadrangular, smooth. Leaves sessile, ovate-lanceolate, acute or acuminate; the margin and nerves scabrous-hairy. Spike 3—8-flowered. Flowers sessile. Segments of the calyx 4 times shorter than the tube of the corolla. Anthers projecting from the tube. Lobes of the corolla lanceolate. Capsule smooth, somewhat shorter than the calyx.

Root perennial, consisting of numerous fibres, from a short, cylindrical rhizome. *Stems* several, winged (from the decurrent leaves). *Leaves* decussate, entire. *Flowers* in simple one-sided spikes (or racemes). *Corolla* much longer than the calyx, of a rich carmine colour externally, paler at the base, and orange-yellow within. *Capsule* obovate, smooth.

Hab.—Southern States of North America; seldom found north of the Potomac.

COLLECTION.—"It is collected by the Creek and Cherokee Indians, who dispose of it to the white traders. By these it is packed in casks, or more commonly in large bales, weighing from three hundred to three hundred and fifty pounds. That contained in casks is to be preferred, as less liable to be damp and mouldy. Owing to the imperfect manner in which the plant is dried, it seldom happens that packages of it reach the market free from dirt and mouldiness, and having the stalks of a bright colour. Some parcels have recently been brought free from the stalks, and have commanded more than double the price of the drug prepared in the usual way."¹

DESCRIPTION.—The dried plant (*herba spigeliæ*) as usually met with in the shops, is of a grayish-green colour, a faint odour, and a bitter taste. The root (*radix spigeliæ*) consists of numerous slender, branching, dark brown fibres, issuing from a short, dark brown rhizome.

COMPOSITION.—The herb and root have been analyzed by Wackenrode.² Feneulle³ probably analyzed this plant under the name of *Spigelia anthelmintica*.

Wackenrode's Analyses.

Myrcin	0.30	Fixed oil	a trace.
Resin, with chlorophyll	2.40	Acrid resin, with some fixed oil	3.13
Peculiar resin	0.50	Peculiar tannin	10.56
Peculiar tannin	17.20	Bitter acrid extractive	4.89
Woody fibre	75.20	Woody fibre (which yields 16.74 of ashes)	82.69
Malate of potash, and chloride of potassium	2.10		
Malate of lime	4.20		
Herb of Spigelia	101.90	Root of Spigelia	101.27

The decoction of spigelia strikes a dark colour with the salts of iron.

1. **BITTER EXTRACTIVE**—Feneulle ascribes the activity of spigelia to a brown, bitter extractive, like that of the purgative Leguminosæ. Taken internally, it causes vertigo and a kind of intoxication. It is, I presume, identical with the *bitter acrid extractive* of Wackenrode.

2. **RESIN**—This is described by Wackenrode as having an acrid, nauseous taste. It is soluble in ammonia and in oil of vitriol. It evolves ammonia when heated.

PHYSIOLOGICAL EFFECTS.—The physiological effects of this root have not been accurately determined; but the observations hitherto made show them to be those of a local irritant (or acrid) and narcotic substance.

In the *ordinary dose* (one or two drachms for adults) it has very little sensible

¹ United States Dispensatory

² Journ. de Pharm. t. ix. p. 597

³ Gmelin's Handb. d. Chem. ii. 1295.

effect on the system, though it may act efficaciously as an anthelmintic. In *larger doses* it appears to operate as an irritant to the gastro-intestinal canal, and gives rise to purging and sometimes to vomiting, though its effects in this way are very uncertain. In *poisonous doses* it operates as a cerebro-spinal or narcotic, giving rise to "vertigo, dimness of vision, dilated pupils, spasms of the facial muscles, and sometimes even to general convulsions. Spasmodic movements of the eyelids have been observed among the most common attendants of its narcotic action. The death of two children, who expired in convulsions, was attributed by Dr. Chambers to the influence of spigelia. The narcotic effects are said to be less apt to occur when the medicine purges, and to be altogether obviated by combining it with cathartics. The danger from its employment cannot be great, as it is in very general use in the United States, both in regular and domestic practice, and we never hear at present of serious consequences. Its effects upon the system have been erroneously conjectured to depend on other roots sometimes mixed with the genuine."¹

USES.—Employed only as an anthelmintic. Its vermifuge properties were first made known to the profession by Drs. Lining² and Garden.³ Though scarcely used in this country, it stands at the head of anthelmintics in the United States of America.

ADMINISTRATION.—The dose of the *powder*, for a child of three or four years old, is from grs. x to grs. xx; for an adult ʒj to ʒiij. This quantity is repeated, every morning and evening, for several days, and then followed by a brisk cathartic. It is frequently combined with calomel.

INFUSUM SPIGELIÆ, Ph. United States; *Infusion of Pink-root*.—(Spigelia Root ʒss; Boiling Water fʒxvj. Macerate for two hours in a covered vessel, and strain.)—The dose, for a child of two or three years old, is fʒss to fʒj; for an adult, from fʒiv to ʒviiij, repeated morning and evening. A quantity of senna, equal to that of the spigelia, is usually added, to insure a cathartic effect.

A preparation kept in the shops of the United States, and much prescribed by physicians, under the name of *worm tea*, consists of spigelia root, senna, manna, and savine, mixed together in various proportions to suit the views of different individuals.⁴

[The *U. S. Pharm.* has a convenient preparation under the name of EXTRACTUM SPIGELIÆ ET SENNÆ FLUIDUM. It is prepared as follows: Take of Pink-root, in coarse powder ℥bj; Senna, in coarse powder ʒvj; Sugar ℥iiss; Carbonate of Potassa ʒvj; Oil of Caraway, Oil of Anise, each fʒss; Diluted Alcohol, a sufficient quantity. Mix the pink-root and the senna with two pints of diluted alcohol, and having allowed the mixture to stand for two days, transfer it to a percolator, and gradually pour upon it diluted alcohol until half a gallon of liquid has passed. Evaporate the liquid by means of a water-bath, to a pint; then add the carbonate of potassa, and after the sediment has dissolved, the sugar previously triturated with the oils. Lastly, dissolve the sugar with a gentle heat.

This preparation combines the properties of the anthelmintic and a purgative, and may, from the smallness of the dose, be conveniently administered to children. Dose, fʒi to fʒij, twice or thrice daily.]

190. Spigelia Anthelmia, Linn.

(Herba; Radix.)

SPIGELIA ANTHELMIA, or *Demerara Pink Root*, is a native of South America and the West India Islands. Its action is similar to that of the last-mentioned species. So poisonous has it been regarded, that in France it is called *Brinvillière*, after the Marchioness de Brinvilliers, a woman famous for poisoning in the reign of Louis XIV., and who was executed on the 16th of July, 1676.⁵ Its anthelmintic properties were noticed in 1751, by Dr. Browne.⁶ This plant was ana-

¹ *United States Dispensatory*.

² *Ibid.* vol. iii. p. 145.

³ Guibourt, *Hist. des Drog.* t. ii. p. 227.

⁴ *Essay and Obs. Phys. and Lit.* vol i. p. 366.

⁵ *United States Dispensatory*.

⁶ *Gentleman's Magazine* for 1751.

lyzed by Ricord Madianna.¹ In the root he found a solid fat, wax, a soft resin called *spigelin* (one grain and a half of which are sufficient to destroy a cat or dog in twenty minutes), resin, brown non poisonous extractive, gum, ligneous fibre, albumen, and gallic acid. The stalks and leaves contained volatile oil, fat, wax, chlorophylle, blackish gummy matter, ligneous fibre, and gallic acid. Dr. Browne² says it procures sleep almost as certainly as opium. Dr. Bonyan³ has recently testified to the anthelmintic efficacy of this plant, which is in great repute among the laborers of British Guiana. It is administered in the form of a decoction. Two or three fresh leaves are said to be a dose.

191. STRYCHNOS NUX-VOMICA, Linn.—THE POISON-NUT.

Sex. Syst. Pentandria, Monogynia.

(Semen; Strychnia; Alkali e nucis vomica comparatum; Crystalli, L.—Seeds, E. D.)

HISTORY.—We became acquainted with *nux-vomica* through the Arabian authors. In the Latin translation of one of the works of Serapion⁴ we find the word *nux-vomica*, but it appears to have been applied to some other substance (probably to St. Ignatius's bean). "Est nux," says he, "cujus color est inter glaucedinem et albedinem, major avellana parum et sunt in ea nodi." To which he afterwards adds, "mouet vomitum;" from which, I presume, the name of *vomic*, or *vomiting-nut*, was originally derived. Mesue also mentions *nux-vomica*. Avicenna⁵ says, *nux-methel* "est similis nuci vomiceæ." It is probable that the *nux-mechil* of Serapion is the substance which we denominate *nux-vomica*.

BOTANY. **Gen. Char.**—*Calyx* 5-lobed. *Corolla* tubular, salver-shaped or funnel-shaped; the throat naked or bearded; limb 5-partite, the lobes valvate in æstivation, spreading during inflorescence. *Stamens* 5, inserted into the throat of the corolla; filaments very short; anthers subexserted. *Ovary* 2-celled. *Style* filiform; *stigma* capitate, undivided, or obscurely subbilobed. *Ovules* indefinite, attached to fleshy placenta, amphitropal, with an inferior micropyle. *Berry* corticated, 1-celled, many-seeded, or by abortion 1-seeded. *Seeds* nidulant in pulp, discoidal-compressed, with a ventral umbilicus; *embryo* at the base of cartilaginous, subbilamelate albumen, excentric, straight, short; the cotyledons sessile, foliaceous; the radicle terete, uncertain (De Cand.).

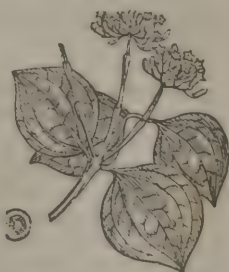
Sp. Char.—Stem arborescous. No spines or cirrhi. Leaves ovate, stalked, 3—5-nerved, quite smooth. Corymbs terminal. Calyx with 5 short teeth. Corolla smooth within. Berry globose, many-seeded. (De Cand.).

Middling-sized tree. *Trunk* short, often crooked, pretty thick; the *branches* irregular; the *wood* white, hard, and bitter. *Leaves* opposite, oval, shining, entire. *Corymbs* small. *Corolla* funnel-shaped, greenish-white. *Style* the length of the corolla. *Stigma* capitate. *Berry* round, smooth, size of a pretty large apple, covered with a smooth, somewhat hard *shell*, of a rich orange-colour when ripe, filled with a white, soft, gelatinous *pulp*, which is greedily eaten by many sorts of birds. *Seeds* several, immersed in the pulp of the berry, and attached to a central placenta.

Hab.—Coromandel, and other parts of India; Ceylon.

DESCRIPTION.—*a. Of the Seeds.*—The *seeds* (*nucis vomica*) of commerce are round, peltate, scarcely an inch in diameter, nearly flat, or very slightly convex on the dorsal surface, and concave on the other or ventral surface, and are usually surrounded by a filiform annular stria. In the centre of the ventral surface of the seed is the orbicular hilum or umbilicus. At one part of their circumference or margin there is a slight promi-

Fig. 309.



Strychnos Nux-vomica.

¹ Gmelin's *Handb. de Chem.* ii. 1297.

² *Pharmaceutical Journal*, vol. v. p. 354, 1846.

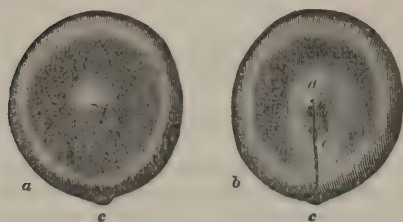
³ *Lab. Indus*, tract. 2ndus, cap. 509.

⁴ *Nat. Hist. of Jamaica*, p. 157.

⁵ *De Simplic. Med.* clixiii. p. 115, Argent. 1531.

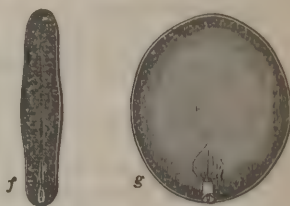
nence, which answers to the chalaza and to the radicle of the embryo. From this prominence to the umbilicus is a more or less obvious line, forming the raphe. From their fancied resemblance to gray eyes, as well as from their being poisonous to crows, the Germans term them *Krähenaugen*, or crows' eyes.

Fig. 310.

*Nux-vomica*.

- a. The dorsal surface.
- b. The ventral or concave surface.
- c. Prominence indicating the chalaza and radicle.
- d. Hilum or umbilicus.
- e. Raphe.

Fig. 311.

Sections of *Nux-vomica*.

- f. Transverse section of seed, showing the bipartite albumen, the cavity, and the embryo.
- g. Vertical section, exposing the internal cavity, and showing the situation and figure of the embryo.

These seeds have two coats: the outer one, or *testa*, is simple, fibrous, and gives origin to short silky hairs, of an ash-gray or yellowish colour, and which are directed from the centre towards the circumference; within this is the inner coat, or *endopleura*, which is simple and very thin, and envelops the nucleus of the seed.

Fig. 312.

Magnified view of a portion of the seed-coats of *Nux-vomica*.

- a. Testa, with hairs attached.
- b. Endopleura.
- c. Albumen.

This nucleus is composed of two parts—namely, albumen and embryo. The *albumen* is bipartite, cartilaginous, or horny; of a dirty-white colour, of an intensely bitter taste, and has, in its interior, a cavity (*loculamentum verum*). Unlike that of most seeds, the albumen of *nux-vomica* is of a poisonous nature. The *embryo*, which is milk-white, is seated in the circumference of the seed, its locality being frequently indicated by a point somewhat more projecting than the surrounding parts. It consists of two large cordiform, acuminate, triple-ribbed, very thin cotyledons, a distinct cauliculus, and a centripetal radicle (*i. e.* a radicle directed towards the centre of the fruit).

β. Of the Bark.—The bark of the *Strychnos nux-vomica* (*nux-vomica* bark; *cortex strychnos nucis vomicæ*; *cortex angusturæ spurixæ* seu *falsæ*; *cortex pseudangusturæ* seu *virosæ*) occurs in quills (*pseudangustura convoluta*), in flat pieces (*pseudangustura plana*), or in pieces arched backwards and twisted (*pseudangustura revoluta*) like dried horn.

The outer or epidermic surface varies in its appearance according to the age of the bark. In the young bark it is ash-gray; and at this period has great resemblance to true *angustura* bark. When somewhat older, it offers numerous whitish or yellowish prominences, which were supposed by Pelletier and Caventou to be a species of lichen (*chiodection*), but which are now known to be an epidermoid alteration or leprous exuberance.¹ At a more advanced stage of its growth, the bark is coated with a rust-coloured corky or spongy layer. In this state it is called rusty false *angustura* (*pseudangustura ferruginea*), though it really has no resemblance to genuine *angustura* bark.

The inner surface of the bark is frequently dark or blackish; but sometimes

¹ Fée, *Essai sur les Cryptog. des Ecorces exot.* p. 16, 1821.

grayish yellow. The pieces seldom exceed four inches in length; they are compact and hard; and break with a smooth fracture. The powder is intensely bitter, without aroma, acridity, or astringency; its colour is dirty yellow, not very dissimilar to that of jalap.

NUX-VOMICA BARK was formerly confounded with angustura or cusparia bark; hence its name of *false angustura bark*. The history of the mistake is as follows: In 1804, Dr. Rambach, a physician at Hamburg, observed that some specimens of angustura bark, said to be from the East Indies, acted as a powerful poison; and as repeated cases of poisoning occurred with the same substance, an order was issued, forbidding the use of angustura bark. On the 15th of October, 1815, the Commission of Health of the Grand Duchy of Baden ordered all the angustura bark in the possession of the apothecaries to be seized, and placed under a seal; the physicians at the same time receiving an intimation that they were not, in future, to prescribe this bark. Similar ordinances were issued in Austria, Bavaria, and Wirtemberg.¹

The origin of the bark is said, by Batka, to be as follows: A quantity of it was imported from the East into England, and not being salable, was sent to Holland; and as no better means of getting rid of it offered, it was mixed with, and sold as, genuine angustura or cusparia bark.² Great obscurity long existed as to the tree which yielded it. At first, it was attributed to the *Bruea ferruginea* or *antidysenterica*, a native of Abyssinia, belonging to the family Xanthoxylaceæ; but in 1831, Geiger had occasion to examine the bark of the *B. ferruginea*, and found that it had no resemblance to false angustura.³ Now the composition and effects of this bark rendered it in the highest degree probable that it was the product of some tree of the genus *Strychnos*; Batka said of the *S. Nux-vomica*, or some kindred species; an opinion which was confirmed by my examination of the specimens of the nux-vomica plant in Dr. Wallich's collection, in the possession of the Linnean Society.⁴ In 1837, Dr. O'Shaughnessy⁵ established the identity of false angustura bark and the bark of the nux-vomica tree. Since then I have examined about 1 cwt. of the latter bark brought to this country, and find it to be identical with false angustura bark contained in my museum, and which I had purchased in Paris several years before.

Nux-vomica (*kuchila*) is commonly sold in Calcutta for *rohun*, the harmless bark of *Soymda febrifuga*; and sulphate of brucia obtained from it was mistaken by Mr. Piddington⁶ for a sulphate of a supposed new alkalioid, to which the name of "rohuna" was given! By the timely discovery of the real nature of this salt, by Dr. O'Shaughnessy, the dreadful consequences which might, and probably would have resulted from its employment as a febrifuge in the Indian army (to which it had been sent as a substitute for sulphate of quinia) were averted.⁷

COMMERCE.—In 1838, duty was paid on 1017 lbs. of nux-vomica; in 1839, on only 478 lbs.; in 1840, on 550 lbs.

COMPOSITION.—The seeds of *Strychnos nux-vomica* have been analyzed by Rese,⁸ Desportes,⁹ Braconnot,¹⁰ Chevreul,¹¹ and Pelletier and Caventou.¹² The most important of these analyses is that made by the last-mentioned chemists; who also examined the bark of *Strychnos Nux-vomica*, under the name of *false angustura*.¹³ The leprous coating of this bark they afterwards¹⁴ submitted to a separate examination, under the idea of its being a lichen.

Pelletier and Caventou's Analyses of the Strychnos Nux-vomica.

1. Of the Seeds.

Strychnic, or igasuric acid.
Strychnia }
Brucia } in combination with strychnic acid.
Wax (a small quantity).
Concrete oil.
Yellow colouring matter.
Gum.
Starch (a little).
Bassorin.
Woody fibre.
Carbonate of lime and chloride of potassium in the ashes.

Nux-vomica seeds.

2. Of the Bark.

Gallate of brucia.
Fatty matter (not deleterious).
Gum (a considerable quantity).
Yellow colouring matter and alcohol.
Sugar (traces).
Woody fibre.

Nux-vomica (*false Angustura*) bark.

The leprous coating was composed of a *greenish yellow oil*, *yellow colouring matter*, *reddish yellow colouring matter* [and *woody fibre*].

¹ Schwartz, *Pharm. Tabell.* S. 95, 2te Aug. 1833; *Hufeland's Journal*, Bd. xix. St. i. S. 181.

² Garbarrat, *Hist. des Drog.* t. ii. p. 1, 3me edit. 1836.

³ *London Medical Gazette*, vol. xix. p. 492.

⁴ *Trans. Med. Phys. Society of Calcutta*, vol. iv.

⁵ Private information furnished me by Dr. O'Shaughnessy, and by Dr. Jackson (the late Apothecary-General of the Indian Army).

⁶ *Pharm. Syst. d. Mat. Med.* Bd. ii. S. 90.

⁷ *Ibid.* t. iii. p. 315.

⁸ *Ann. Chem. et Phys.* t. x. p. 142.

⁹ *Journ. de Pharm.* t. v. p. 546.

¹⁰ *Pharm. Central-Blatt für 1831*, S. 477.

¹¹ *Madras Journal* for April, 1837.

¹² *Bull. de Pharm.* t. i. p. 271.

¹³ *Orfila, Toxicol. Gén.*

¹⁴ *Ann. Chim. et Phys.* t. xii. p. 113.

1. **STRYCHNIA**—See p. 545.

2. **BRUCIA**; *Brucina*; *Caniramin*; *Vomicina*; $\text{Br}=\text{C}^4\text{H}^2\text{N}^2\text{O}^7$, Liebig; or $\text{C}^6\text{H}^{26}\text{N}^2\text{O}^8$, Regnault; Eq. Wt.=373 Liebig; or 394, Regnault. Discovered in 1819, by Pelletier and Caventou; exists in the bark and seeds of nux-vomica, and in St. Ignatius's bean; in the two latter substances it is associated with strychnia, and is in combination with igasuric acid, while in the bark of nux-vomica it is combined with gallic acid. The separation of brucia from strychnia is founded on its greater solubility in alcohol than the latter alkaloid. Brucia in the anhydrous form, as obtained by fusing it, has a waxy appearance; but when combined with water, $\text{Br}+\text{SHO}$, it is capable of crystallizing, the form of the crystals being oblique four-sided prisms; or sometimes the crystals have a pearly laminated appearance, something like boracic acid. Its taste is very bitter, though less so than that of strychnia. It is soluble in 850 parts of cold, or 500 parts of boiling, water; but the presence of colouring matter, of which it is difficult to deprive it, promotes its solubility. It is very soluble in alcohol, but is insoluble in ether and the fixed oils, and is very slightly soluble only in the volatile oils. Nitric acid communicates a fine red colour to brucia; and the colour changes to violet on the addition of proto chloride of tin; sulphuretted hydrogen and sulphurous acid destroy the colour. Chlorine communicates a red colour to brucia.¹ Bromine communicates a violet tint to the alcoholic solution of brucia. Sulphuric acid first reddens brucia, and then turns it yellow and green.

According to Dr. Fuss,² brucia is not a peculiar alkaloid, but a compound of strychnia and resin [yellow colouring matter]. He says that he has proved this both analytically and synthetically; and he ascribes the property of brucia to become reddened by nitric acid and by chlorine, to the resin present. Prof. Erdmann, who examined the products of Fuss's experiments, has confirmed his statements.

The salts of brucia are readily formed by saturating dilute acids with brucia. They possess the following properties: For the most part they are soluble and crystallizable, and have a bitter taste. They are decomposed by potash, soda, ammonia, the alkaline earths, morphia, and strychnia, which precipitate the brucia. They produce precipitates (*tannate of brucia*) on the addition of tannic acid. Nitric acid colours them as it does free brucia.

The effects of brucia on man and animals appear to be precisely similar to those of strychnia, though larger doses are required to produce them. Magendie³ considers it to possess only one twelfth the activity of strychnia; while Andral regards it as having one-sixth the power of impure strychnia, and one twenty-fourth that of pure strychnia. Dose, half a grain, which is to be gradually increased to five grains. It may be given in the same way as strychnia.

3. **STRYCHNIC OR IGASURIC ACID**.—Exists in the seeds of nux-vomica, St. Ignatius's bean, and snake-wood. Igasuric acid is crystallizable, and has an acid, rough taste. It is soluble in water and alcohol. The salts of iron, mercury, and of silver in solution, are unaffected by it; but those of copper are rendered green; and after some time a light green precipitate is deposited.

4. **YELLOW COLOURING MATTER**.—Found in the seeds and bark of nux-vomica, in St. Ignatius's bean, and the Upas Tieuté. Also in *Strychnos pseudo-guinia*, Casca d'Anta, and Pereira Bark. It is soluble in water and alcohol, and is reddened by nitric acid [and by chlorine].

5. **REDDISH YELLOW COLOURING MATTER**.—Resides in the rust-coloured epidermoid alteration of nux-vomica bark. Also in *Strychnos pseudo-guinia*. It is insoluble in cold water and in ether, but dissolves with facility in alcohol. Nitric acid renders it deep green by combining with it.

6. **OTHER CONSTITUENTS**.—The wax mentioned in the above analysis is probably derived from the hairs with which the seeds are invested; it enables them to resist moisture. Resin is probably a constituent of the seeds; for tincture of nux-vomica is rendered milky by water. An *odorless, non-acid, innocuous* principle is obtained by submitting nux-vomica and water to distillation. Meissner detected *copper* in the ashes of nux-vomica; but I have several times repeated his experiment without recognizing this metal.

CHEMICAL AND OTHER CHARACTERISTICS. 1. **Of the Seeds**.—*Powdered nux-vomica* has a fallow gray colour, a bitter taste, and a peculiar odour, analogous to that of liquorice. Submitted to microscopic examination fragments of hair are perceived in it (see Fig. 312, p. 534). Thrown on burning coal it inflames when the temperature is very high; but when lower, is decomposed, evolves a thick white smoke of a peculiar odour, and leaves a carbonaceous residuum. Concentrated sulphuric acid blackens it. Nitric acid communicates to it a *deep orange-yellow colour*.⁴ If the powder be digested with boiling water acidulated with sulphuric acid, the filtered liquor is turbid and slightly yellow. Nitric acid, after some minutes, reddens it; ammonia makes it brown, and precipitates blackish flocks. If

¹ Pelletier, *Journ. de Pharm.* xxiv. p. 158.

² *Berlinisches Jahrbuch für die Pharmacie*, Bd. xliii. S. 407, 1840.

³ *Formulaires*.

⁴ Powder of nux-vomica adulterated with guaiacum wood-dust becomes at first bluish green, afterwards orange yellow.

the sulphuric solution be digested with finely powdered marble (to saturate the excess of acid), then evaporated to dryness, and the residue treated with boiling alcohol, we obtain a spirituous solution of sulphates of strychnia and brucia, with colouring matter. This has a bitter taste, is reddened by nitric acid, produces convulsions when given to birds or other small animals, and forms a flocculent coloured precipitate on the addition of ammonia. Sometimes crystals are deposited from the alcoholic liquor, on standing for two or three days.¹

Ammoniacal sulphate of copper added to the *infusion* or *decoction* of *nux-vomica*, produces an emerald-green colour, and gradually a greenish-white precipitate (*igarsurate of copper*); ammoniacal sulphate of strychnia remains in solution. Sesquichloride of iron also produces an emerald colour, which disappears on the addition of hydrochloric acid; this coloration does not depend, according to Pelletier and Caventou, on the igasuric acid; nor can it depend on tannic acid, for gelatin gives no indication of this substance; if the decoction be boiled with animal charcoal, it loses the power of becoming green on the addition of a ferruginous salt. Nitric acid communicates an orange-red colour to the decoction, owing to its action on the brucia and yellow colouring matter. A solution of iodine communicates a yellowish-brown tint to the decoction; but after a few minutes the colour disappears (owing, perhaps, to the formation of the hydriodates of strychnia and brucia), and the iodine is no longer detectable by starch, without the addition of nitric acid or chlorine. Tannic acid, or infusion of nutgalls, produces in the decoction a copious precipitate (*tannates of strychnia, brucia, and some other vegetable matter*). Alcohol also causes a precipitate (*gum*). Diacetate of lead causes an abundant precipitate composed of *gummate and igasurate of lead, with colouring and fatty matter*.

2. Of the Bark.—An infusion of this bark reddens litmus, in consequence of the excess of acid present. Strong nitric acid added to this solution produces a red colour; and by dropping the acid on the inner surface of the bark, a blood-red spot is produced; in both cases, the effect arises from the action of the acid on the brucia and yellow colouring matter. If nitric acid be applied to the external surface of the bark, it produces a deep green colour, in consequence of the action of the acid on the yellow colouring matter (see *Strychnos pseudo-quinia*, p. 559). Infusion of galls added to the infusion of this bark occasions a white precipitate (*tannate of brucia*). Sulphate of iron colours the infusion green, from its action on the yellow colouring matter. (For other characteristics, see **ANGOSTURA BARK**.)

ADULTERATION.—Powder of *nux-vomica* is sometimes adulterated by guaiacum wood-dust.² The presence of guaiacum is shown by the following tests: 1st. On the addition of nitric acid the powder becomes at first bluish-green; 2d. By digestion in rectified spirit a tincture is obtained, which, being spread on paper, and exposed to nitrous fumes, becomes bluish-green.

PHYSIOLOGICAL EFFECTS. **1. Of the Bark.** *a. On Animals generally.*—The experiments of Pfaff, the Vienna faculty, Emmert, Meyer, Orfila, Magendie, and Jager,³ have shown that it is a powerful poison to dogs, rabbits, wolves, and other animals. Thus eight, twelve, or eighteen grains of it kill dogs, the symptoms being precisely the same as those of *nux-vomica* already detailed. Emmert (quoted by Christison) inferred, from experiments made on animals, that this bark acts on the spine directly, and not on that organ through the medium of the brain.

β. On Man it also acts as a powerful poison. Emmert⁴ mentions that a boy who had taken by mistake the decoction of this bark died therefrom. His intellectual powers were unaffected; he entreated his physician not to touch him, as violent convulsions were immediately brought on; he was powerfully sweated, but did not vomit. Prof. Marc was nearly poisoned by swallowing through mistake three quarters of a liqueur-glassful of a strong vinous infusion.⁵

¹ Orfila and Bueruel, *Arch. Gén. de Méd.* viii. 22; R. D. Thomson, *Brit. Ann. of Med.* i. 106.

² *Pharmaceutical Journal*, vol. x. p. 419.

³ *Wibmer, Werk d. Arzney-u. Gift Bd. i. S. 182*

⁴ Quoted by Wibmer, *Werk. d. Arzney-u. Gift Bd. i. S. 188.*

⁵ *Journ. de Pharm.* t. ii. p. 507.

2. *Of the Seeds.* *a. On Vegetables.*—Marcet¹ states, that a quarter of an hour after immersing the root of an haricot plant (*Phaseolus vulgaris*) in a solution of five grains of the extract of nux-vomica in an ounce of water, the petals became curved downwards, and in twelve hours the plant died. Fifteen grains of the same extract were inserted in the stem of a lilac-tree, on July 5, and the wound closed. In thirteen days the neighbouring leaves began to wither.

β. On Animals generally.—Nux-vomica appears to be poisonous, in a greater or less degree, to most animals. On the vertebrata its effects are very uniform, though larger quantities are required to kill herbivorous than carnivorous animals. Thus, a few grains will kill a dog, but some ounces are required to destroy a horse.² It occasions in all tetanic convulsions, increased sensibility to external impressions, asphyxia, and death.³ The bird called *Buceros Rhinoceros* is, however, said to eat the nuts of strychnos and not to be subject to their noxious influence.⁴

γ. On Man.—Three degrees of the operation of nux-vomica on man may be admitted.

αα. First degree: tonic and diuretic effects.—In very small and repeated doses, nux-vomica usually promotes the appetite, assists the digestive process, increases the secretion of urine, and renders the excretion of the fluid more frequent. In some cases it acts slightly on the bowels, and occasionally produces a sudorific effect. The pulse is usually unaffected. In somewhat larger doses the stomach not unfrequently becomes disordered, and the appetite impaired.

ββ. Second degree: rigidity and convulsive contraction of the muscles.—In larger doses the effects of nux-vomica manifest themselves by a disordered state of the muscular system. A feeling of weight and weakness in the limbs, and increased sensibility to external impressions (of light, sound, touch, and variations of temperature), with depression of spirits and anxiety, are usually the precursory symptoms. The limbs tremble, and a slight rigidity or stiffness is experienced when an attempt is made to put the muscles into action. The patient experiences a difficulty in keeping the erect posture, and, in walking, frequently staggers. If, when this effect is beginning to be observed, he be tapped suddenly on the ham while standing, a slight convulsive paroxysm is frequently brought on, so that he will have some difficulty to prevent himself from falling. I have often in this way been able to recognize the effect of nux-vomica on the muscular system, before the patient had experienced any particular symptoms.

If the use of the medicine be still persevered in, these effects increase in intensity, and the voluntary muscles are thrown into a convulsed state by very slight causes. Thus, when the patient inspires more deeply than usual, or attempts to walk, or even to turn in bed, a convulsive paroxysm is brought on. The sudden contact of external bodies also acts like an electric shock on him. The further employment of nux-vomica increases the severity of the symptoms; the paroxysms now occur without the agency of any evident exciting cause, and affect him even when lying perfectly quiet and still in bed. The muscular fibres of the pharynx, larynx, œsophagus, and bladder, also, become affected; and Trousseau and Pidoux⁵ say those of the penis are likewise influenced, and the nocturnal and diurnal erections become inconvenient even in those who, for some time before, had lost somewhat of their virility. I am acquainted with two cases of paralysis, in which the use of nux-vomica caused almost constant nocturnal erection. Females also, say Trousseau and Pidoux, experience more energetic venereal desires; and “we have,” they add, “received confidential information on this point, which cannot be doubted.”

The pulse does not appear to be uniformly affected; for the most part it is slightly increased in frequency between the convulsive attacks, but Trousseau says he has found it calm even when the dose of the medicine was sufficient to cause general

¹ *Ann. Chim. et Phys.* t. xxix.

² *Orfila, Toxicol. Gén.*

³ *Traité de Thérap.* t. i. p. 515.

⁴ Moiroud, *Pharm. Vét.* p. 266.

⁵ *Müller's Physiology*, by Baly, vol. i. p. 478.

muscular rigidity. Previous to the production of the affection of the muscles, various painful sensations are oftentimes experienced in the skin, which patients have compared to the creeping of insects (formication), or to the passage of an electric shock; and occasionally an eruption makes its appearance.

It is remarkable that in paralysis the effects of nux-vomica are principally observed in the paralyzed parts. Magendie¹ states he has observed sweating confined to the paralyzed parts. "I have seen," says this physiologist, "the affected side covered with an anomalous eruption, while the opposite side was free from it. One side of the tongue is sometimes sensible of a very bitter taste, which is not perceptible to the other side."

γγ. Third degree: tetanus, asphyxia, and death.—To illustrate this third and most violent degree of operation, I think I cannot do better than relate a case of poisoning by nux-vomica reported by Mr. Ollier.²

A young woman swallowed between three and four drachms of this substance in powder, and in half an hour was seen by Mr. Ollier. She was sitting by the fire, quite collected and tranquil; her pulse about 80, and regular. He left her for about ten minutes to procure an emetic, and on his return found that she had thrown herself back in her chair, and that her legs were extended, and considerably separated. She was perfectly sensible, and without pain; but seemed in alarm, laid hold of her husband's coat, and entreated him not to leave her. A perspiration had broken out on her skin, her pulse had become faint and much quicker, and she called frequently for drink. She then had a slight and transient convulsion. Recovering from it, she was in great trepidation, kept fast hold of her husband, and refused to let him go, even for the alleged purpose of getting her drink. In a few minutes after she had another and a more violent attack, and shortly afterwards a third; the duration of these was from a minute and a half to two minutes. In them she retained her grasp; her whole body was straightened and stiffened, the legs pushed out and forced apart. I could not (says Mr. Ollier) perceive either pulse or respiration; the face and hands were livid; the muscles of the former, especially of the lips, violently agitated; and she made constantly a moaning, chattering noise. She was not unlike one in an epileptic fit, but did not struggle, though, as she was forced out, it was difficult to keep her from falling on the floor.

In the short interval of these attacks she was quite sensible; was tormented with incessant thirst; perspired; had a very quick and faint pulse; complained of being sick and made many attempts to vomit. (I should state she had swallowed some ipecacuanha powder to evacuate the poison.) She continued to refuse to let her husband move, and to the question whether she was in pain, replied, "No—no—no!"

A fourth and most vehement attack soon followed, in which the whole body was extended to the utmost; and she was rigidly stiff from head to foot, inasmuch that, with all the force of the surgeon, he could not bend her thighs on the pelvis to replace her in her seat. From this she never recovered; she fell into a state of asphyxia, and never breathed again. She now relaxed her grasp; her discoloured hands dropped upon her knees; her face, too, was livid; the brows contracted; the lips wide apart, showing the whole of the closed teeth; and a salivary foam issued plentifully from the corners of her mouth. The expression of the whole countenance was at this time very frightful. On removal of the body, it was discovered that the urine had been discharged. She died in about an hour after taking the poison. Five hours afterwards, she was still as straight and stiff as a statue; if you lifted one of her hands, the whole body moved with it; but the face had become pale in comparison, and its expression more placid.

POST-MORTEM APPEARANCES.—In the case just related the body was observed to be rigid after death, but in the lower animals the reverse is generally noticed. As in other cases where death takes place from obstructed respiration, venous congestion is observed. Occasionally, there is redness or inflammation of the alimentary canal, and now and then softening of the brain or spinal cord.

MODUS OPERANDI.—There are several points connected with the modus operandi of nux-vomica which require investigation:—

1st. Is this seed a local irritant?—In medicinal doses it does not usually disorder the stomach, nor is it invariably irritant in its operation, even when swallowed as a poison. In some instances, however, the pain and heat in the stomach, the burning in the gullet, and the nausea and vomiting, are evidences of its local action; and in several cases marks of inflammation have been observed in the stomach on examination of the body after death. Strychnia also is a local irritant.

¹ *Formulaires*, 8me edit. p. 7.

² *Lond. Med. Repos.* vol. xix. p. 448.

2dly. *Does the active principle of nux-vomica become absorbed?*—To this inquiry our answer is decidedly Yes. (See vol. i. pp. 152 and 153).

3dly. *On what part of the body does nux-vomica exercise a specific effect?*—The muscular contractions caused by nux-vomica arise chiefly from changes effected in the nervous stimulus, and not from alterations in the contractility of the muscular fibre; for Matteucci¹ found that, in frogs poisoned by nux-vomica, when the excitability of the nerves was destroyed, and when the electric current which was applied to them no longer occasioned muscular contractions, the muscles themselves, when submitted directly to the action of the current, underwent contraction.

Every part of the nervous system is probably specifically affected by nux-vomica, though the principal manifestations of its actions are in the functions of the cerebro-spinal system.

The tetanic symptoms, and the absence of narcotism, have led to the conclusion that the spinal cord was the part principally affected—a conclusion supported by the fact that the division of this cord, nay, even complete decollation, will not prevent the poisonous effects of nux-vomica; whereas, the destruction of the cord by the introduction of a piece of whalebone into the spinal canal, causes the immediate cessation of the convulsions; and if only part of the cord be destroyed, the convulsions cease in that part of the body only which is supplied with nerves from the portion of medulla destroyed. These facts, then, originally observed by Magendie, and which I have myself verified, lead to the conclusion, that the abnormal influence, whatever it may be, which causes the convulsions to take place, is not derived from the contents of the cranium, but from the medulla spinalis itself. Moreover, as the motor nerves seem principally affected, it has been presumed that the disorder is chiefly seated in the anterior columns of the cord. It is probable, however, that both the posterior columns and the gray matter of the cord are affected by it.²

But nux-vomica affects the sensibility of the body; and heightens the sensations of touch, vision, and hearing (see vol. i. p. 238). These effects are referable to its action on the cerebrum; though Dr. Stannius³ considers that this increased susceptibility to external impressions arises from the action of the poison on the spinal cord. Although the intellectual functions are not usually much disordered by this drug, yet the mental anxiety commonly experienced by persons under its use, the occasional appearance of stupor, and the observations of Andral and Lallemand on the injurious effects of it in apoplexies, with cerebral softening, leave no doubt that the cerebrum is affected by this agent. Bally⁴ has observed an appearance of stupor, vertigo, tinnitus aurium, sleeplessness, and turgescence of the capillaries of the face result from the use of strychnia.

M. Flourens⁵ asserted, that the part of the nervous system on which nux-vomica more particularly acted was the medulla oblongata. But MM. Orfila, Ollivier, and Drogartz,⁶ in their report on a case of poisoning by this substance, particularly mention that they observed no traces of alteration in the condition of the medulla oblongata, the tuber annulare, or the crura cerebri—which is in opposition to Flourens's opinion; for he asserted, that the specific or exclusive action of each substance on each organ, always left, after death, traces of its action sufficient to distinguish the affected from other organs.

The cerebellum is said, by some, to be acted on by nux-vomica, but for the most part on hypothetical grounds; though it must be mentioned that MM. Orfila, Ollivier, and Drogartz observed the cerebellum presented more evidences of lesions than the other parts of the nervous system. Another argument, which probably would be advanced by phrenologists in favour of the cerebellum being affected by this drug, is the observation of Trousseau, that the sexual feelings are usually excited by it.

¹ *Traité des Phénom. Electro-Physiol. des Animaux*, pp. 241—242, Paris, 1844.

² The white nervous fibres are merely conductors of nervous power; the gray matter, on the other hand, is a generator or source of nervous power (see Grainger, *Struct. and Funct. of the Spinal Cord*, p. 17).

³ *Brit. and For. Med. Rev.* vol. v. p. 221.

⁴ *Rech. Expér. sur les Fonct. du Syst. Nerv.* 1824.

⁵ *Ibid.* vol. vi. p. 225.

⁶ *Arch. Gén. de Méd.* viii. 22.

The ganglia also appear to be affected by nux-vomica; and hence the influence which this agent exercises over the movements of the intestinal canal and heart.

Ségalas¹ found, in his experiments on animals, that in some cases life could not be prolonged by artificial respiration, and that after death the heart could not be stimulated to contract. These and other reasons seem to show that nux-vomica exhausts the irritability of the heart. But in all probability this viscus is affected only secondarily, the essential and primary action being on the nervous system.

The nerves themselves are likewise affected; for, in the last stage of poisoning by nux-vomica, the nerves of frogs lose, partially or wholly, their susceptibility when submitted to the electrical current.²

4thly. *What kind of action does nux-vomica set up in those parts of the nervous system on which it acts?*—As the muscles receive from the nervous system a preternatural stimulus to action, it is presumed that this system (or at least certain parts of it) is in a state of excitement or irritation. In one case mentioned by Mr. Watt,³ there was observed softening of the lumbar portion of the spinal cord; and in the case reported by MM. Orfila, Ollivier, and Drogartz, the whole cortical substance of the brain, especially of the cerebellum, was softened. Andral and Lallemand have both observed that this remedy, in some forms of apoplexy, produced symptoms indicating ramollissement.

5thly. *What is the reason that in general strychnia first displays its remarkable influence on paralytic limbs?*—No satisfactory explanation of this fact has been hitherto offered. The following are some hypotheses:—

a. According to Ségalas, the muscles of the unaffected limbs being simultaneously subject to the government of the brain and the action of the poison, are better enabled to resist the latter than paralyzed muscles, which, not being under cerebral influence, are more affected by the poison. To this hypothesis, however, insuperable objections present themselves. Under the influence of strychnia, paralyzed parts sometimes suffer violent pain, while the healthy parts are free from it. How, asks Ollivier,⁴ is this specific influence on paralyzed parts only to be explained? Does it not show, moreover, that these parts are not so entirely isolated from the influence of the nervous centres as the hypothesis of Ségalas would lead us to infer?

β. Dr. Marshall Hall⁵ thus explains it: When the paralysis is cerebral, the irritability of the muscular fibre becomes augmented, from want of the application of the stimulus of volition; and in such cases, therefore, strychnia first affects the paralyzed muscles, because these are more irritable than the sound ones. But in spinal paralysis the irritability is diminished, and in such strychnia does not firstly and mostly affect the paralyzed limbs.

This explanation appeared to me so plausible and satisfactory, that in the first edition of this work I adopted it, believing it to present a clear and physiological elucidation of the facts before related. But, in the summer of 1841, I made a number of observations on paralytic patients in the London Hospital, which convinced me that it does not correctly interpret the phenomena in question. The following is a brief abstract of one case, out of many similar ones:—

A middle-aged man was admitted into the hospital suffering with hemiplegia of two years' standing, and the consequence of apoplexy. He was put under the influence of the alcoholic extract of nux-vomica. In a few days the muscles of the paralyzed limbs were powerfully affected by the remedy, but those of the sound side were unaffected by it. I then resolved to try the effects of voltaic electricity on the paralyzed and healthy muscles. For this purpose, I directed each hand to be placed in a separate basin containing a solution of salt. The two basins were then respectively connected with the electrodes of a magneto electric machine, and a current of electricity thus simultaneously traversed the paralyzed and healthy arms. To my great surprise the muscles of the paralyzed arm were comparatively but slightly affected, while those of the sound one were most powerfully convulsed. This experiment was tried repeatedly, and invariably with the same result.

In this case the paralysis was undoubtedly, I think, cerebral. On Dr. Hall's hypothesis, the effects of strychnia on the paralyzed limbs proved it to be so. Yet the paralyzed muscles were less irritable than the sound ones, as manifested by voltaic electricity. I have observed the same effects in many other cases. Similar results as to the condition of the paralyzed muscles have also been obtained by Dr. Copland⁶ and Dr. Todd.⁷

¹ Quoted by Dr. Christison.

² Christison, p. 183.

³ *Medical-Chirurgical Transactions*, 2d series, vol. iv. Lond. 1839.

⁴ *Dict. of Pract. Medicine*, vol. iii. p. 42; *Lancet*, Dec. 20, 1845, p. 670.

⁵ *Medical-Chirurgical Transactions*, 2d series, vol. xii. p. 207, 1847.

⁶ Mattucci, *op. ante citato*.

⁷ *Traité de la Moelle Epinière*, p. 841. Paris. 1827.

γ. Dr. Todd says that "the tendency of strychnia to affect the paralytic limbs before the healthy ones, is attributable to its being attracted in greater quantity to the seat of the lesion in the brain than to the corresponding part on the other side." This hypothesis assumes that in all these cases a larger quantity of blood is "attracted" to the affected part of the brain than to the sound parts—an assumption which cannot be admitted.

6thly. *Is any change produced in the blood-disks by strychnia?*—Müller¹ says strychnia produces no change in them; and Dr. Stannius² was unable to detect, by means of the microscope, any alteration in the appearance of the blood of frogs poisoned by strychnia.

7thly. *In what manner is death produced by nux-vomica?*—Frequently by the stoppage of respiration, in consequence of the spasmodic condition of the respiratory muscles. In other cases death seems to arise from excessive exhaustion of the nervous power (see Cloquet's case, quoted by Christison).

USES.—The obvious indications for the use of nux-vomica, strychnia, or brucia, are torpid or paralytic conditions of the motor or sensitive nerves, or of the muscular fibre; while these agents are contra-indicated in spasmodic or convulsive diseases. Experience, however, has fully proved that, when paralysis depends on inflammatory conditions of the nervous centres, these agents prove injurious, and accelerate organic changes.

1. *In paralysis.*—Of all the diseases for which nux-vomica has been employed, in none has it been so successful as in paralysis; and it is deserving of notice, that this is one of the few remedies whose discovery is not the effect of mere chance, since Fouquier³ was led to its use by legitimate induction from observation of its physiological effects. That a remedy which stimulates so remarkably the muscular system to action should be serviceable when that system no longer receives its accustomed natural stimulus is, *à priori*, not astonishing. Paralysis, however, is the common effect of various lesions of the nervous centres, in some of which nux-vomica may be injurious, in others useless, and in some beneficial. It is, therefore, necessary to point out under what circumstances this remedy is likely to be advantageous or hurtful.

A very frequent, and, indeed, the most common cause of paralysis, is hemorrhage of the nervous centres. Blood may be effused on the external surface of these centres, into their cavities, or in their substance, the latter being by far the most common case—in the proportion, according to Andral,⁴ of 386 out of 392 instances of cerebral hemorrhage. It is almost superfluous to add that the radical cure of these cases can be effected only by the removal (that is, absorption) of the effused blood. Now the process by which this is effected is almost entirely a natural one; art can offer no assistance of a positive kind, though, by the removal of impeding causes, she may be at times negatively useful. Nux-vomica can, in such cases, be of no avail; on the contrary, it may be injurious.

The part immediately surrounding the sanguineous clot is usually much softened—a condition formerly regarded as the effect of the effusion. But Lallemand has satisfactorily shown that it often, though not invariably, precedes the hemorrhage. This softening, or *ramollissement*, is, according to the same authority, a constant and necessary result of an acute or chronic irritation. But the facts at present known do not warrant this generalization, since cases occur which apparently are unconnected with irritation. For this softening art can do but little; we have, in fact, no particular or uniform treatment. If we can connect with it any increased vascular action, of course bloodletting and the other antiphlogistic means are to be resorted to; whereas, if the reverse condition of system exist, marked by great languor and debility, tonics and stimulants may be administered. Nux-vomica in these cases offers no probability of benefit; on the contrary, we might suspect that, as it irritates the spinal cord, it might probably have the same effect on the brain, and hasten the production of softening. Now experience seems to confirm our

¹ *Physiology*, by Baly, vol. i. p. 107.

² Bayle, *Bibl. Thérap.* t. ii. p. 141.

³ *Brit. and For. Med. Rev.* vol. v. p. 222

⁴ *Path. Anat.* by West, vol. ii. p. 722

theoretical anticipations. Andral¹ relates the case of a man who was hemiplegic, in consequence of an old apoplectic attack. A pill, containing only one-twelfth of a grain of strychnia (the active principle of nux-vomica), was given to him, and it produced a strong tetanic stiffness of the paralyzed members. The following day he complained of pain in the head, on the side opposite to that paralyzed; his intellectual functions were weaker and his hemiplegia was increased; in fact, he had all the symptoms characterizing softening of the brain. It is, therefore, probable that the strychnia set up an inflammatory condition of the nervous substance around the apoplectic deposit, and that this condition was the precursor of ramollissement. When, therefore, nux-vomica is employed in those cases of paralysis which are connected with inflammation of the brain or spinal marrow, it is very likely to increase the evils it is intended to mitigate. Lallemand² reports two cases in which this drug, administered against cerebral maladies, occasioned convulsive movements, which continued until death. On opening the bodies, the cerebral substance surrounding the sanguineous clot was found disorganized and exceedingly softened. These facts suggest some useful reflections as to the use of this powerful drug in paralysis, and prevent its indiscriminate use in all cases of this disease.

But there are cases in which paralysis, arising from cerebral hemorrhage, may be advantageously treated by nux-vomica. The blood which is poured out in the apoplectic cell has at first a gelatinous consistence, some of it still remaining fluid. "Somewhat later," says Andral,³ "twelve or fifteen days after the attack, for instance, the coagulum is found to be firmer and more circumscribed; later still, it becomes white or yellow, and is surrounded by a brownish-red fluid. The walls of the containing cavity are smooth, and lined with a delicate membrane. The surrounding cerebral substance in some cases retains its natural appearance, and in others is altered both in colour and consistence. As the interval between the effusion and the examination increases, the coagula gradually disappear." The cyst is now found to contain a serous fluid, occasionally having a few cellular bridges running from one side to the other; and nature subsequently attempts to get rid of the cyst by producing adhesion of its sides, leaving only a linear cicatrix. Now it is well known that by long disuse of some of the voluntary muscles, the power over them becomes gradually diminished; and it appears that occasionally in cerebral hemorrhage, after the absorption of the effused blood, the paralysis remains, as it were by habit. In these cases the cautious employment of nux-vomica, or of its active principle, may be attended with beneficial results, by favouring the return both of motion and sensation.

But paralysis, like some other diseases of the nervous system, may exist without our being able to discover after death any lesion of the nervous centres; and it is then denominated a functional disorder, as if there were actually no organic lesion. To me, however, the fact of the lesion of action is a strong ground for suspecting that there must have been an organic lesion of some kind, though we see nothing. "It is highly probable," says Andral,⁴ "that some organic lesions do exist in such cases, though they escape our notice." Be this as it may, experience has fully established the fact, that nux-vomica is more beneficial in those forms of paralysis usually accompanied by visible lesions of structure; such, for example, as paralysis resulting from exposure to the influence of lead and its various compounds. Thus, of ten cases of saturnine hemiplegia, treated by nux-vomica or its active principles, and which are mentioned by Bayle, three were cured, and three ameliorated.

As hemiplegia more frequently depends on cerebral hemorrhage than some other forms of paralysis, so it is, for the most part, less amenable to remedial means. Thus, while out of twenty-six cases of paraplegia, nineteen were cured by nux-vomica, or its active constituents, yet in thirty instances of hemiplegia only thirteen were cured. In six cases of general paralysis (that is, paralysis of both sides at once),

¹ Bayle, *B. M. Thérap.* t. ii. p. 227.

² *Recherches anatomico-pathologiques sur l'Encéphale*, p. 267, 1820.

³ *Path. Anat.* by West, vol. ii. p. 723.

⁴ *Ibid.* p. 709.

four were cured by this remedy. In the paralysis which sometimes affects the muscles of certain organs, nux-vomica (or strychnia) has been employed with advantage. Thus a case of amaurosis, accompanied with paralysis of the eyelid, is said to have been cured by it; and several cases of incontinence of urine, depending on paralysis, or diminished power of the muscular fibres of the bladder, have also been benefited by the same means. In some cases of local paralysis, strychnia has been employed endermically with benefit.

2. *Paralysis of the sentient nerves.*—The good effects procured from the use of nux-vomica in paralysis of the motor nerves, have led to its employment in functional lesions of sentient nerves, characterized by torpor, inactivity, and paralysis. That benefit may be obtained in these cases is physiologically probable, from the circumstance that one of the effects of this agent is an exaltation of the susceptibility to external impressions, as I have before mentioned. Hitherto, however, the trials have not been numerous, nor remarkably successful.—In *amaurosis*, benefit has been obtained in some few instances; and where no organic lesion is appreciable, this remedy deserves a trial. The endermic method of using it has been preferred. Small blisters, covered with powdered strychnia, have been applied to the temples and eyebrows. The remedy causes sparks to be perceived in both eyes, especially the affected one; and it is said, the more of these, the better should be the prognosis: moreover, the red-coloured sparks are thought more favorable than sparks of other colours. When the malady is complicated with disease of the brain, the remedy must be employed with extreme caution.

3. *Other affections of the nervous system.*—I have seen nux-vomica very serviceable in shaking or tremor of the muscles produced by habitual intoxication. A gentleman thus affected, who had for several weeks lost the power of writing, reacquired it under the use of this medicine. *Chorea* has been benefited by it.¹ In *tetanus*, it has been tried at the London Hospital without any augmentation of the convulsions. Several cases of *epilepsy* are said to have been relieved by it;² but, judging from its physiological effects, it would appear to be calculated to act injuriously, rather than beneficially, in this disease; and in one case³ the use of strychnia apparently caused paralysis and death. It has also been employed in *hypochondriasis* and *hysteria*.⁴ It has also been used in *neuralgia* with good effect.⁵

4. *Affections of the alimentary canal.*—On account of its intense bitterness, nux-vomica has been resorted to as a tonic and stomachic in *dyspepsia*, especially when this affection depends on, or is connected with, an atonic condition of the muscular coat of the stomach.

In *pyrosis*, resulting from simple functional disorders of the stomach, Mr. Mellor⁶ considers it to be almost a specific. Even when pyrosis is symptomatic of organic disease of the stomach, he says it is of essential service. In febrile states of the system its use is contra-indicated. Dr. Belcombe⁷ has confirmed these statements, and also speaks of its good effects in *gastrodynia*. In *dysentery*, particularly when of an epidemic nature, nux-vomica has gained some reputation. Hagstrom says he has proved its value in some hundreds of cases;⁸ and his report has been confirmed by Hufeland,⁹ Geddings,¹⁰ and others. In *colica pictorum*, a combination of strychnia and hydrochlorate of morphia has been found, by Bally, highly successful.¹¹ In *prolapsus of the rectum*, Dr. Schwartz¹² has recommended the use of this remedy, which he has employed for ten years, both in adults and children, with great benefit. One or two grains of the alcoholic extract are to be dissolved in two drachms of water; and of this solution he gives to infants at the breast two or three drops; to older children from six to ten or fifteen drops, according to their age. In partial *borborygmi* of females I have found nux-vomica useful.

¹ Magendie, *Formulaire*.

² *Ibid.* p. 233.

³ *Lond. Med. Gaz.* Aug. 7, 1840.

⁴ *Ibid.* p. 964.

⁵ *Ibid.* p. 136.

⁶ *Ibid.* vol. vi. p. 225.

⁷ Bayle, *Bibl. Thérap.* t. ii. pp. 135 and 230.

⁸ *Ibid.* p. 131.

⁹ *Lond. Med. Gaz.* xix. p. 851.

¹⁰ Bayle, *op. cit.* p. 135.

¹¹ *Brit. and For. Med. Rev.* vol. i. p. 255.

¹² *Lond. Med. Gaz.* vol. xvi. p. 763.

5. *In impotence*.—The excitement of the sexual feelings, which Trousseau has seen produced by nux-vomica, led him to employ this remedy against impotence, and he has found it successful both in males and females. In some cases, however, its good effects were observed only while the patients were taking the medicine. A young man, twenty-five years of age, of an athletic constitution, who had been married for eighteen months without having any other than almost fraternal communications with his wife, acquired his virility under the use of nux-vomica, though he again lost it soon after leaving off its employment. In spermatorrhœa, it has been used with occasional benefit.

The preceding are the diseases in which nux-vomica has proved most successful. It has, however, been used in several others (as *intermittent fevers, intestinal worms, &c.*) with occasional benefit.

ADMINISTRATION.—Nux-vomica is used in the form of *powder, tincture, or extract*. *Strychnia* and *brucia* may be regarded as other preparations of it. The *powder* of nux-vomica is administered in doses of two or three grains gradually increased. Pouquier has sometimes increased the quantity to fifty grains.

ANTIDOTE.—Evacuate the contents of the stomach as speedily as possible. No chemical antidotes are known. Probably astringents (as infusion of galls, green tea, &c.) would be serviceable. Donné¹ regards chlorine, iodine, and bromine, as antidotes for strychnia and brucia; but farther evidence is required to establish the correctness of his inferences. Emmert² says that vinegar and coffee increased the poisonous effects of nux-vomica (false angustura) bark. To relieve the spasms, narcotics may be employed. Sachs and others have recommended opium. As conia is the counterpart of strychnia, it deserves a trial. I applied it to a wound in a rabbit affected with tetanus from the use of strychnia; the convulsions ceased, but the animal died. In the absence of conia, the extract of hemlock should be employed. Ether and oil of turpentine have been recommended.³ To relieve the excessive endermic operation of strychnia, acetate of morphia applied to the same spot has given relief.

1. TINCTURA NUCIS-VOMICÆ [U. S.]; *Tincture of Nux-vomica*.—(Nux-vomica, scraped, ℥ij; Rectified Spirit ℥viij. Macerate for seven days, and filter.)—Dose, ℥v to ℥x. It is sometimes used as an embrocation to paralyzed parts, and its good effects in this way seem to be increased by combining it with ammonia.

2. EXTRACTUM NUCIS-VOMICÆ, E. [U. S.]; *Extract of Nux-vomica*.—("Take of Nux-vomica any convenient quantity; expose it in a proper vessel to steam till it is properly softened; slice it, dry it thoroughly, and immediately grind it in a coffee-mill; exhaust the powder either by percolating it with rectified spirit, or by boiling it with repeated portions of rectified spirit until the spirit comes off free of bitterness. Distil off the greater part of the spirit; and evaporate what remains in the vapour-bath to a proper consistence," *E.*)—[The *U. S. Pharm.* directs Nux-vomica ℥bj; Alcohol a sufficient quantity. The directions are the same as of the *E. P.*] Dose, gr. ss, gradually increased to two or three grains. The extract is given in the form of pill.

3. STRYCHNIA, L. E. D. [U. S.]; *Strychnine; Strychnina; Vauquelina; Tetanine*.—In the anhydrous state its composition, according to Regnault, is $C^{12}H^{12}N^2O^4 = \ddot{S}r$. Eq. Wt.=334. This alkaloid was discovered in 1818 by Pelletier and Caventou. It has been found in *Strychnos Nux-vomica*, *S. Ipatia*, *S. colubrina*, and *S. Tienté*. In these plants it is frequently associated with brucia, and is always combined with an acid.

In the *London Pharmacopœia* for 1850, no directions are given for the preparation of this alkaloid, which is placed in the materia medica.

¹ *Journ. de Pharm.* t. xvi. p. 377.

² *Pharbus. Hufschers bei acut. Vergift.* S. 4.

³ Buchner, *Toxikol.* S. 235—6.

The directions of the *Edinburgh College* are as follows:—

“Take of Nux-vomica ℥ij; Quicklime ℥iiss; Rectified Spirit a sufficiency. Subject the nux-vomica for two hours to the vapour of steam, chop or slice it, dry it thoroughly in the vapour-bath or hot-air press, and immediately grind it in a coffee-mill. Macerate for twelve hours in two pints of water, and boil it; strain through linen or calico, and squeeze the residuum; repeat the maceration and decoction twice with a pint and a half of water. Concentrate the decoctions to the consistency of thin syrup; add the lime in the form of milk of lime; dry the precipitate in the vapour bath, pulverize it and boil it with successive portions of rectified spirit till the spirit cease to acquire a bitter taste. Distil off the spirit till the residuum be sufficiently concentrated to crystallize on cooling. Purify the crystals by repeated crystallization.”

In this process, a decoction of nux-vomica is prepared; this contains the igasurate of strychnia with gum. This salt is decomposed by the lime, and the strychnia abstracted by rectified spirit.

In the *Dublin Pharmacopœia* for 1850, the process given is as follows:—

“Take of Nux-vomica, in powder, 1 lb; Water one gallon and a half; Oil of Vitriol of commerce half a fluidounce; Slacked lime one ounce; Rectified Spirit one quart; Dilute Sulphuric Acid, Solution of Ammonia, of each a sufficient quantity; Prepared Animal Charcoal half an ounce. Macerate the nux-vomica for twenty-four hours with half a gallon of the water, acidulated with two drachms of the acid, and, having boiled for half an hour, decant. Boil the residuum with a second half-gallon of the water, acidulated with one drachm of the acid; decant, and repeat this process with the remaining water and acid, the undissolved matter being finally submitted to strong expression. The decanted and expressed liquors having been passed through a filter, and then evaporated to the consistence of a syrup, let this be boiled with the rectified spirit for twenty minutes, the lime being added in successive portions during the ebullition, until the solution becomes decidedly alkaline. Filter through paper, and having drawn off by distillation the whole of the spirit, let the residuum be dissolved in the dilute sulphuric acid, and to the resulting liquid, after having been cleared by filtration, add the solution of ammonia in slight excess, and let the precipitate which forms be collected upon a paper filter, dried, and then dissolved in a minimum of boiling rectified spirit. Into this solution introduce the animal charcoal, digest for twenty minutes, then filter, and allow the residual liquor to cool, when the strychnia will separate in crystals.” The weights used in this process are avoidupois.

[The process of the *U. S. Pharm.* differs from either of the above. It directs Nux-vomica, rasped, ℥iv; Lime, in powder, ℥vj; Muriatic Acid ℥ij; Alcohol; Diluted Sulphuric Acid; Solution of Ammonia; Purified Animal Charcoal; Water, each a sufficient quantity. The first step in the operation is to convert the strychnia into a muriate by boiling, with water acidulated by the acid, and repeat twice. Next, decompose the muriate by the lime, which separates the strychnia. Take this up by alcohol, and convert it into a sulphate by boiling with dilute sulphuric acid; decolor by the charcoal, and finally separate the strychnia by the solution of ammonia, and dry on bibulous paper.]

By digesting nux-vomica in water acidulated with sulphuric acid, the sulphates of strychnia and brucin are obtained. The lime decomposes these, and sets free a mixture of strychnia and brucia, which are dissolved by the spirit, and again converted into sulphates by the addition of sulphuric acid. The ammonia decomposes these sulphates; sulphate of ammonia is formed in solution, and the alkaloids are again set free, and are then dissolved by boiling alcohol. The hot alcoholic solution, being decolorized by animal charcoal, deposits on cooling the strychnia, the brucia being left in solution.

As a considerable quantity of mucilage is precipitated by the lime, Molyn¹ has proposed to avoid this by subjecting the nux-vomica (reduced to a coarse powder and made into a paste with water) to the process of fermentation. Carbonic acid is evolved, the gummy and saccharine constituents are decomposed, and lactic acid is produced, which decomposes the igasurate of strychnia and brucia, and forms with these alkaloids very soluble lactates. In eighteen or twenty days the fermentation is completed.

Pure strychnia is a white, odourless, intensely bitter, crystalline substance, the form of the crystals being the octohedron or four-sided prism. When rapidly crystallized, it assumes the granular form. It is fusible, but not volatile; decomposing at a lower temperature than most vegetable bodies. Though so intensely bitter, it

¹ *Pharmaceutical Journal*, vol. vi. p. 492, 1847.

is almost insoluble in water, one part of strychnia requiring 6667 parts of water, at 50°, to dissolve it; that is, one grain needs nearly fourteen ounces of water to hold it in solution. It requires 2500 parts of boiling water to dissolve it. It is slightly soluble in boiling rectified spirit, but scarcely so in cold water. It acts on vegetable colours as an alkali, saturates acids forming salts, and separates most of the metallic oxides (the alkaline substances excepted) from their combinations with acids. In some cases, part only of the metal is precipitated, a double salt being formed in solution. Thus, when strychnia is boiled with a solution of sulphate of copper, a green solution of *cupreous sulphate of strychnia* is obtained, while a portion only of the oxide of copper is precipitated.

Strychnia is recognized by its crystallizability, its alkaline properties, its combustibility, its intense bitterness, its difficult solubility in alcohol, ether, and water, and solubility in dilute acids. A solution of bichloride of mercury added to a solution of strychnia in hydrochloric acid, causes a white clotty precipitate (composed of *bichloride of mercury and hydrochlorate of strychnia*). Tannic acid or tincture of nutgalls occasions a whitish precipitate in a neutral solution of hydrochlorate of strychnia. Marchand¹ has pointed out a very characteristic test for strychnia; if a small portion of strychnia be rubbed with some drops of oil of vitriol containing a hundredth part of its weight of nitric acid, no change of colour takes place (provided the strychnia be pure); but if a minute quantity of the puce-coloured oxide (per-oxide) of lead be added to the mixture, the liquid assumes a fine blue colour, which rapidly becomes blue, then gradually red, and after a few hours yellow. Mack² has proposed to substitute peroxide of manganese, and Otto³ bichromate of potash, for the peroxide of lead.

Commercial strychnia usually forms, with strong nitric acid, a red-coloured liquid, which afterwards becomes yellow. This change does not occur with pure strychnia, but depends on the presence of one or both of the two substances—viz. brucia and yellow colouring matter. As the red colour is destroyed by decolorizing agents (sulphurous acid and sulphuretted hydrogen), it appears to depend on the oxidization of the substance referred to. If potash be added to a very concentrated solution of a strychnian salt which has been reddened by nitric acid, an orange precipitate is formed; an excess of water dissolves this precipitate.

According to the Edinburgh College, strychnia for medicinal use, which is declared to be “always more or less impure,” possesses the following properties:—

Intensely bitter; nitric acid strongly reddens it; a solution of 10 grains in 4 fluidrachms of water by means of a fluidrachm of pyroligneous acid, when decomposed by one fluidounce of concentrated solution of carbonate of soda, yields on brisk agitation a coherent mass, weighing when dry 10 grains, and entirely soluble in solution of oxalic acid.

The London College (1850) gives the following characters for crystallized strychnia:—

It is dissolved in boiling alcohol. It melts by heat, and if it be more strongly urged, it is totally dissipated. It tastes very bitter. Being endowed with violent powers, it is to be cautiously administered.

The *salts of strychnia*, when pure, are for the most part crystalline, white, and very bitter. They possess the following chemical characteristics: 1st, the alkalies and their carbonates occasion white precipitates in solutions of the strychnia salts; 2dly, they are precipitated by tannic, but not by gallic acid; 3dly, they are unchanged by the action of the persalts of iron.

The only salt of strychnia in the British Pharmacopœias is the muriate contained in the *Dublin Pharmacopœia* for 1850.

STRYCHNINÆ HYDROCHLORAS; *Strychniæ + Murias*, Ph. Dubl. 1850; *Hydrochlorate* or *Muriate of Strychnia*.—Formula, $\text{Sr, HCl} + 2\text{HO}$. Equivalent weight=

¹ *Journ. de Pharm. et de Chimie*, 3me sér. t. iv. p. 200, 1843.

² *Pharmaceutical Journal*, vol. vi. p. 187, 1846.

³ *Ibid.* vol. vi. p. 479, 1847; see, also, a paper by Mr. L. Thompson, in *Pharm. Journ.* vol. ix. p. 24, 1849.

389. The Dublin College gives the following directions for the preparation of this salt:—

“Take of Strychnia one ounce; Dilute Muriatic Acid one fluidounce, or a sufficient quantity; Distilled water two ounces and a half. Pour the acid upon the strychnia, and, adding the water, apply heat until a perfect solution is obtained. Let this cool, and let the crystals which form be dried upon bibulous paper. By evaporating the residual liquid to one-third of its bulk, and then allowing it to cool, an additional quantity of the salt will be obtained.” The weights used are avoirdupois.

This salt crystallizes in four-sided needles, which lose their transparency in the air. It is much more soluble in water than the sulphate. When heated, it is decomposed with the evolution of hydrochloric acid.

The effects of strychnia are of the same kind as those of nux-vomica, but more violent in degree. As ordinarily met with in the shops, it may be regarded as about six times as active as the alcoholic extract of nux-vomica. The following are a few examples of its poisonous operation:—

Dr. Christison¹ says: “I have killed a dog in two minutes, with the sixth part of a grain, injected in the form of alcoholic solution, into the chest: I have seen a wild boar killed, in the same manner, with the third of a grain, in ten minutes.” Pelletier² says: “half a grain, blown into the mouth of a dog, produced death in five minutes.” Half a grain, applied to a wound in the back of a dog, caused death in three minutes and a half. In all these and other instances death was preceded and accompanied by tetanus. The salts of strychnia act in the same manner.

Some individuals are more susceptible of the action of strychnia than others. Andral³ has seen a single pill, containing one-twelfth of a grain, cause slight trismus, and the commencement of tetanic stiffness of the muscles; while in other cases the dose may be gradually increased beyond a grain, with comparatively little effect. The largest dose I have given is a grain and a half, and this was repeated several times before the usual symptoms, indicative of the affection of the system, came on. Smaller doses had been previously given without any obvious effect. Subsequent experience has satisfied me that so large a dose was dangerous.

The following case occurred on board the Dreadnought Hospital Ship, and was communicated to me by Mr. Cooper, Surgeon:—

A Swede, aged 50—60, was admitted about the year 1833 with general paralysis, one side being more affected than the other; he was also in some degree idiotic. Strychnia was given, at first in the dose of one eighth of a grain three times a day, which was continued for several weeks, without apparent effect. The dose was then increased to one-quarter of a grain three times a day, which was also continued for some time, and not producing any perceptible effect, the quantity was increased to half a grain twice or three times a day, and this dose was taken for many days before any influence of strychnia was manifested. But one morning, about 9 A. M., the apothecary was suddenly summoned by a message that the man was in a fit. When seen he was insensible; face and chest of a deep purple colour; respiration had ceased, and the pulsation of the heart nearly so. The whole body (trunk and limbs) was in a state of tetanic spasm. Trunk extended, and shoulders thrown back: muscles of chest and abdomen hard and rigid. In a short time the rigidity became less; the ribs could be compressed; and artificial respiration was kept up imperfectly by compression of the thorax. Circulation was restored in some degree, and the deep purple colour of the surface went off. Spontaneous respiration returned. The man sighed, and became apparently sensible; all spasm had ceased for a minute or two; but as soon as circulation and consciousness were in some degree restored, the spasm recurred with extreme violence, again locking up the respiratory muscles. Respiration ceased; the surface again became purple: circulation went on, however, some time after respiration had ceased. Artificial respiration was kept up when the relaxation of the muscles would allow of it, but was this time ineffectual. The heart soon ceased to beat; the deep purple colour was instantaneously replaced by the pallor of death; and life was extinct.

The quick passing off of the purple colour of the surface was very remarkable; the change appeared to commence in the face, and passed downwards like the passing of the shadow of a cloud.

This case gives some colour to the idea that strychnia, like digitalis and some other potent remedies, accumulates in the system.

¹ *Treatise on Poisons*, 3d edit. p. 797.

² Bayle, *Bibl. Thérap.* t. ii. p. 227.

³ *Ann. de Chim. et Phys.* x.

A melancholy case of poisoning by strychnia occurred in 1848: a lady swallowed a dose of a mixture containing nine grains of strychnia, which had been introduced by mistake for salicine. It is supposed she must have swallowed between two and three grains of strychnia. She became suddenly ill, was violently convulsed and in great agony, and died in less than two hours.¹

The local action of strychnia is that of an irritant. Applied to the naked dermis, it causes burning and pungent pain, lasting from half an hour to an hour; and where blisters have been applied, the raw surface inflames under the use of the remedy, and affords a copious suppuration.²

The uses of strychnia are similar to those of nux-vomica above stated.

The *dose* of strychnia or its salts (*acetate, sulphate, nitrate or hydrochlorate*) is, at the commencement, one-sixteenth or one-twentieth of a grain, which is to be very gradually increased until its effects on the muscular system are observed. Strychnia is usually given in the form of *pill* (made with common conserve of roses) or it may be dissolved in *alcohol* or *acetic acid*. The *endermic* dose of strychnia should not, at the commencement, exceed half a grain, and of its salts one-fourth of a grain.

192. Strychnos Tieute, Leschinault.

Tshetik or *Tjettek*.—A large climbing shrub, growing in Java. The aqueous extract of the bark of this tree is the poison called *Upas tieuté Tjettek*, or *Upas Radja*, and which must not be confounded with the poison of the *Antiaris toxicaria*, before described (see *ante*, p. 347). The *Upas tieuté* was analyzed by Pelletier and Caventou,³ who found it to consist of *strychnia combined with an acid* (igasuric?), a *reddish-brown colouring matter*, which becomes green when mixed with nitric acid, and a *soluble yellow colouring matter*, which is reddened by nitric acid. They could detect no brucia. The effects of this poison are precisely similar to those of nux-vomica and strychnia. Thus, when applied to wounds, injected into the serous sacs or blood-vessels, or applied to the mucous membrane, it produces tetanus, asphyxia, and death. Forty drops of *Upas* dissolved in water, and injected into the pleura of an old horse, gave rise almost immediately to tetanus and asphyxia, and the animal died after the second attack.

193. Strychnos colubrina, Linn.

(Lignum.)

A large tree, a native of Silhet. In countries infested with poisonous serpents, the natives have usually some substance which is fancied to possess the power of preserving them from the bites of these poisonous animals; and thus we have various articles, seeds, roots, and wood, which have the word *snake* affixed to them.

In Asia, there are several kinds of *lignum colubrinum*, or *snake-wood*, supposed to be possessed of the above-mentioned property. The specimens, however, met with in commerce, show that there are various substances to which this term is applied; some being the wood of a stem, others of a root. The most esteemed is the wood of the *Strychnos colubrina*. The *S. ligustrina* yields the ancient *lignum colubrinum* of *Timor*. Pelletier and Caventou⁴ analyzed one of these woods, and found that it had the same constituents as the bean of St. Ignatius, though in different proportions. Thus it contained more fatty and colouring matter, less strychnia, and, in the place of bassorine and starch, a larger quantity of woody fibre. Its action, therefore, is precisely similar to the before-mentioned poisons.

194. Strychnos Potatorum, Linn.

(Semina.)

Clearing Nut.—A large tree; a native of Silhet. The fruit is a shining berry about the size of a cherry, and, when ripe, is black. It contains one seed, which is about the size of a cherry-stone. These seeds, when ripe and dried, are sold in the markets of India to clear water. They have recently been imported into London under the name of *nirmulles* or *nirmillies*. "The

¹ *Pharmaceutical Journal*, vol. viii. p. 298, 1848.

² *Abramsen, Brit and For. Med. Rev.* vol. v. p. 350.

³ *Ann. de Chim. Phys.* xxvi. 41.

⁴ *Ann. de Chim. Phys.* x. 170.

Fig. 313.

Fruit of the *Strychnos*
Potatorum.

natives never drink clear well water if they can get pond or river water, which is always more or less impure, according to circumstances. One of the seeds is well rubbed for a minute or two round the inside of the vessel containing the water, generally an unglazed earthen one, which is then left to settle; in a very short time the impurities fall to the bottom, leaving the water clear, and, so far as I have been able to learn, perfectly wholesome. These seeds are constantly carried about by the more provident part of our officers and soldiers in time of war, to enable them to purify their water. They are easier to be obtained than alum.¹ Their efficacy depends, as I have elsewhere² suggested, on their albumen and casein, which act as fining agents, like those employed for wine and beer. If the seeds be sliced and digested in water, they yield a thick, mucilaginous, ropy liquid, which, when boiled, furnishes a coagulurn (albumen), and, by the subsequent addition of acetic acid, a farther coagulurn (casein). It is obvious, therefore, that many other seeds might be substituted for those of the *Strychnos Potatorum*.

Almonds, beans, castor seeds, Kola nuts (*Sterculia acuminata* Pal. de Beauv.), &c. are used for similar purposes in some countries.

195. *Strychnos Pseudo-quina*, St. Hilaire.

(Cortex.)

A small tree, about 12 feet high, growing in the Brazils. The bark, called *Quina do Campo*, is employed in the Brazils as a substitute for cinchona bark. It does not possess poisonous properties. It was analyzed by Vauquelin,³ who discovered neither strychnia nor brucia in it. Mercadieu⁴ also analyzed it under the erroneous name of *copalchi* (see ante, p. 372), and could not discover any vegetable alkali in it. The internal surface of the bark (liber), touched by nitric acid, becomes red; while the external surface becomes blackish-green.⁵ In these characters, then, it agrees with *nux-vomica* bark. It is employed in intermittents, in diseases of the liver, spleen, and mesenteric glands, and in dyspepsia.⁶

196. *Strychnos toxifera*, Benth.

(Succus.)

Strychnos toxifera, Benth., pl.; Schomburgk, in Hooker's Journ. Bot. iii. 240; Hooker, Icones, t. 364 and 365; Schomb., Ann. of Nat. Hist. vii. 411, 1841.—A poisonous tree, with a tortuous trunk, growing in British Guiana. Its juice forms the basis of the *Ouari* or *Wourah* (also called *Urari* and *Woorara*) poison used by the savages of Guiana. This poison causes paralysis, with convulsive movements, and death from suspended respiration; hence artificial respiration is a most important means of averting its fatal effects.⁷ Attention has been more recently drawn to its effects by Mr. Waterton.⁸ It has been proposed to employ it in tetanus and hydrophobia. Mr. Sewell conjectured that if a horse in tetanus were destroyed by poison which acts by suppressing nervous power, and life were then to be restored by artificial respiration, the nervous system, on reanimation taking place, might possibly be free of the original morbid irritation.⁹ Dr. Hancock¹⁰ has used the bark of this plant as an application to foul ulcers.

197. *Ignatia amara*, Linn.

Sex. Syst. Pentandria, Monogynia.

(Semina.)

Strychnos Ignatii, Bergius, Mat. Med. 149.—A tree indigenous to the Philippine Islands, whose fruit is smooth and pyriform, and contains about 20 seeds. The seeds, the *St. Ignatii's* beans of the shops, are about the size of olives, rounded and convex on one side, and somewhat angular on the other. Externally they are brownish, with a bluish-gray tint. Within the envelops of the seed is a very hard, horny, or cartilaginous albumen, in whose cavity is contained the embryo. These seeds have been analyzed by MM. Pelletier and Caventou,¹¹ who found

¹ Roxburgh's *Flora Indica*, vol. i. p. 576, Serampore, 1832.

² *Pharmaceutical Journal*, vol. ix. p. 478.

³ *Journ. de Chim. Méd.* t. i. p. 236 bis.

⁴ Martius, *Syst. Mat. Med. Veg. Brasil.* p. 41, 1843.

⁵ *Lancet*, April 12 and 19, 1839; also, *Brit. and For. Med. Review*, vol. viii. p. 597, 1839.

⁶ Mayo's *Outlines of Physiology*; Waterton, *op. citato*. ¹¹ *Lond. Med. Gaz.* vol. xx. p. 251.

¹⁰ *Ann. de Chim. Phys.* x. 147.

⁷ *Mém. du Muséum*, p. 452, 1823.

⁸ Guibourt, *Journ. de Pharm.* t. xxv. p. 509.

⁹ Brodie, *Phil. Trans.* for 1811, p. 17.

their constituents to be the same as those of *nux-vomica*, though in somewhat different proportions. Their effects, therefore, are similar.

These seeds came into the Dutch shops, according to Alston,¹ about the latter end of the seventeenth century. But there is some reason to suspect that they were known long before this, and are probably the substances which, in the Latin translation of Serapion, were denominated *nux vomica*. Dale² gives, as one of their synonyms, "Igasur, seu Nux-vomica legitima Serapionis."

ORDER XLVII. ASCLEPIADACEÆ, Lindley.—ASCLEPIADS.

ASCLEPIADEÆ, R. Brown.—APOCINEARUM PARS, Juss.

CHARACTERS.—*Flowers* symmetrical. *Calyx* 5-partite. *Corolla* monopetalous, 5-lobed, hypogynous, deciduous, regular; the throat naked, or furnished with glands at the sinus, or with variously formed appendages, which are more or less deeply adnate to the tube of the stamens (*gynostegium*). *Stamens* 5, inserted into the base of the corolla and alternate with its segments; filaments usually combined so as to form a tube inclosing the pistillum (*stylostegium*; *gynostegium*), rarely free; anthers 2-celled (spuriously 4-celled); pollen, when the anther dehiscens, cohering in masses (*pollinia*), and sticking to 5 processes of the stigmas by twos or fours, or singly. *Ovaries* 2; *styles* 2; *stigma* common to both styles, dilated, 5-cornered, with cartilaginous corpuscles at the angles, which retain the pollen masses. *Follicles* 2, one of which is often abortive. *Seeds* numerous, usually comose at the micropyle, albuminous. *Shrubs*, or occasionally *herbs*, usually with a milky juice, often twining. *Leaves* entire, opposite (occasionally whorled, or alternate), with interpetiolar cilia in place of stipules.

PROPERTIES.—The medicinal qualities reside in a bitter acrid juice, which possesses emetic, purgative, diaphoretic, and stimulating properties.

198. *Hemidesmus indicus*, R. Brown

Sez. Syst. Pentandria, Digynia.

(Radix.)

Periploca indica, Willd., Sp. Plant.; *Asclepias pseudosarsa*, Roxb., Fl. Ind.; *Ununtamul*, Hind. and Beng.; *Nannari* or *Nannarivayr*, Tamul.—A common twining shrub in India. Its root (*radix hemidesmi indicæ*; *rad. nannari*) is used in India under the name of *country sarsaparilla*. The attention of practitioners in this country was drawn to it by Dr. Ashburner, in 1831;³ and again in 1833.⁴ It has been called *Indian* or *scented sarsaparilla*, *nannari*, or the root of *Smilax aspera*. How this last and erroneous appellation became applied to it I cannot tell; for I find from specimens of the root of *Smilax aspera* brought from the south of Europe, that no resemblance exists between the latter and the root of *Hemidesmus indicus*. The latter is brownish externally, and has a peculiar aromatic odour, somewhat like that of saffraas, but which has been compared to that of new hay, and a feeble, bitter taste. It is long, tortuous, cylindrical, rugous, furrowed longitudinally, and has its cortex divided, by transverse fissures, into moniliform rings. The cortical portion has a corky consistence, and surrounds a ligneous medullium. Mr. Garden⁵ obtained from it a volatile, crystallizable acid, (!) on which the taste, smell, and, probably, the medicinal properties depend. From an erroneous notion of the origin of the root, he called the acid the *smilaspermic acid*, but it may with more propriety be termed *hemidesmic acid* or *hemidesmin*. *Hemidesmus indicus* has been employed as a cheap and efficacious substitute for sarsaparilla in cachectic diseases; but both its effects and uses require a more extended examination than has yet been devoted to them. Dr. Ashburner says that it increases the appetite, acts as a diuretic, and improves the general health; "plumpness, clearness, and strength, succeeding to emaciation, muddiness, and debility." It has been used with benefit in venereal diseases. In some cases it has appeared to succeed where the sarsaparilla has failed; and, *vice versa*, it has frequently failed where sarsaparilla succeeds. The Tamool doctors employ it in strangury and gravel.⁶ It may be administered in the form of *infusion* (prepared by steeping ʒij of the root in Oj of boiling [or lime] water for twelve hours); a pint of which may be given in twenty-four hours, in doses of a wineglassful. The *decotion* may be substituted for the infusion. Carbonate of soda is frequently added to it. The *extract* is objectionable, as the heat used in preparing it must volatilize part at least of the hemidesmic acid. The *powder of the bark of the root* is used in India against the thrush.⁷

SYRUPUS HEMIDESMI, D.; Syrup of Indian Sarsaparilla.—"Take of Indian Sarsaparilla, bruised, four ounces; Boiling Distilled Water one pint; Refined Sugar, in powder, as much as

¹ Lect. on the Mat. Med. vol. ii. p. 38.

² Lond. Med. and Phys. Journ. vol. lxx. p. 1089.

³ Ibid. vol. xx. p. 800.

⁴ Roxburgh, Fl. Ind. vol. ii. p. 40.

⁵ Pharmacol. p. 328.

⁶ Lond. Med. Gaz. vol. xii. p. 350.

⁷ Ainslie, Mat. Ind. vol. i. p. 382.

is sufficient. Infuse the sarsaparilla in the water for four hours in a covered vessel, and strain; set it by until the sediment subsides, then decant the clear liquor, and, having added to it twice its weight of sugar, dissolve with the aid of a steam or water heat.)—The weights here directed to be used are avoirdupois.

Mr. Jacob Bell¹ has given the following directions for preparing it: Take of the root of *Hemidesmus indicus* 1 lb. avoirdupois; Refined Sugar 1 lb.; Distilled Water about three pints. Bruise the root, separate the bark by sifting, and reject the wood. Add to the bark an equal bulk of washed sand, moisten them with water, and pack in a displacement apparatus. Macerate for four hours, and displace the liquor by the requisite quantity of water; reserving the first six ounces. Add more water until it passes through tasteless, and evaporate it to three ounces, in which, with the addition of the first six ounces, dissolve the sugar with as moderate a heat as possible. The result is twenty ounces by measure of a syrup possessing all the aromatic qualities of the plant.

199. *Calotropis gigantea*, R. Brown.

Sex. Syst. Pentandria, Digynia.

(Radix, cortex, et succus.)

Asclepias gigantea, Willd., Sp. Pl. i.; *Madorius*, Rumph., Amboyn., vii. t. 14. f. 1; *Mudar*, Hind.—A large branching shrub, a native of the East Indies; growing in the West Indies. Stem often as thick as a man's leg or thigh. Yields when wounded a large quantity of an acrid milky juice. Dr. O'Shaughnessy² found that this milk when dried in the water bath loses 75 per cent. According to the analysis of J. B. Ricord Madianna,³ 100 parts of this [inspissated] juice consist of pure resin 9, fatty oil 4, solid balsam 9, cerine 12, ligneous matter from the bark of the tree 6, mucus 8, caoutchouc 45, loss by evaporation 7=100. The root (*radix mudaris gigantea*) according to Ricord is reddish, with an odour somewhat like that of horseradish. It is covered with a bark which is three or four lines thick, and which under the epidermis is white. The dried bark, such I have received it (through the kindness of my colleague Mr. Wordsworth) from St. Kitts, is in hard, curved, or somewhat twisted pieces, which break short and smooth, and externally are whitish or grayish yellow, and internally white. They are very amylaceous, and when examined by the microscope are seen to abound in round, hemispherical, or muller-shaped starch grains, whose hilum is very distinct. This bark has a mucilaginous, bitter, somewhat acrid, and nauseous taste. Dr. O'Shaughnessy describes it as having a heavy and very peculiar smell; but my sample scarcely agrees with this statement. Dr. Duncan⁴ obtained from the dried root bark much starch, a white resin, and 11 per cent. of an extractive bitter principle called *mudarine* or *madarin*. This last-mentioned substance, like emetine, excites vomiting, and, according to Dr. Duncan, is the active principle of the root. Its watery solution has the remarkable property of coagulating or gelatinizing by heat, and of becoming fluid again by cold. The inspissated juice, root, and bark, have been extensively used in the East for their emetic, sudorific, alterative, and purgative qualities. It has been employed in a great variety of diseases, especially obstinate cutaneous maladies, as lepra and elephantiasis, syphilis, and some spasmodic affections. Mr. Robinson⁵ found it decidedly useful in a species of elephantiasis, which Mr. Playfair⁶ calls jugura or leprosy of the joints. It has also been used as a substitute for ipecacuanha. In doses of from three to seven grains the dried bark produces nausea and diaphoresis, and in this quantity has been found very efficient in some cutaneous affections. In doses of from fifteen to twenty grains it excites, in from twenty minutes to an hour, full vomiting, with much nausea, and, in some cases, purging. In very small doses it has been reputed tonic, stomachic, and expectorant. An oil of *mudar* is prepared by digesting 10 grains of the powdered bark in one ounce of olive oil, and pouring off the oleaginous solution from the insoluble portion. The oil may be applied by means of a camel-hair pencil to cutaneous ulcers.⁷ Dr. Ainslie⁸ considers the dried milky juice the most efficacious preparation.

CALOTROPIS PROCERA, R. BROWN.—Dr. Wallich tells us that this is the real *Mudar* of India.

200. *Solenostemma Argel*, Hayne.—Argel.

Sex. Syst. Pentandria, Digynia.

(Folia.)

Cynanchum oleosolum, Neetoux, Voyage dans la Haute Egypte, t. iii. p. 20, 1808; *Cynanchum Argel*, Delile, Flor. Egypt. p. 53, pl. 20, fig. 2, 1826; *Argel*, Arabicæ.—A shrub; a native of Upper

¹ *Pharmaceutical Journal*, vol. iii. p. 239, 1843.

² *Journ. de Pharm.* t. xvi. p. 92, 1830.

³ *Edinb. Med. and Surg. Journ.* July 1, 1829; *Lond. Med. Gaz.* July 18, 1829, p. 213.

⁴ *Med. Chir. Trans.* vol. x. p. 27.

⁵ *Trans. of the Med. and Phys. Society of Calcutta*, vol. i. p. 84.

⁶ *Buchner's Repertorium für d. Pharmacie*, 2te Reihe, Bd. v. p. 102, 1836.

⁷ *Materia Indica*, vol. i. p. 486; vol. ii. p. 488.

⁸ *Bengal Dispensatory*.

Egypt, Nubia, Arabia Petrea, and Ouadi Gurra. Stem 2 feet high, erect, branched. Leaves lanceolate, with a short petiole, leathery, veinless, whitish, wrinkled, and glaucous on the under surface. Umbels many flowered. Flowers small and white. Follicles ovoid, tapering superiorly.

Fig. 314.



Argel leaf, flowers, and fruit.

The leaves form a portion of most samples of Alexandrian senna (see *Senna*). The plant is collected, for this purpose, by the Arabs, in the valleys of the desert to the east and south of Assouan (Delile). According to Dublane, jun.¹ the leaves consist of a *volatile oil* (to which the smell of the leaves is ascribable); a bitter, nauseous, *extractiform matter* (in which the purgative qualities of the leaves appear to reside); *chlorophylle*; a *gummy matter*, analogous to bassorine; a *glutinous substance*: a *fatty matter*; *acetate of potash*; and *mineral salts*. According to the observations of Rouillure, Delile, Nectoux, and Pugnet (quoted by Delile), the argel leaves are more active than senna leaves. Rouillure says they purge and gripe, and are used by the Arabs of Upper Egypt without the addition of senna. But more recent observations² appear to show that, though they occasion sickness and griping, they do not produce purging. Herberger³ even asserts that they are harmless, because an infusion of two and a half drachms produced no effect or inconvenience. But this probably arose from the active principle of the leaves being insoluble in water.

[*Asclepias tuberosa*, Linn., U. S. SEC. LIST.—Pleurisy Root, Butterfly Weed.

The stem of this plant is erect, hairy, with spreading branches; leaves, oblong, lanceolate, sessile, alternate, somewhat crowded; umbels numerous, forming terminate corymbs (Beck); flowers orange-yellow. This plant is found in all parts of the United States. The portion used in medicine is the root. It is large, and formed of irregular tubers or fusiform branches; externally of a yellowish-brown colour, internally white. When recent, it has a somewhat acrid, nauseous taste: in the dried state the taste is bitter, but not unpleasant. The powder is dirty white. It yields its properties to boiling water.

The effects of this root upon the system are those of a diaphoretic and expectorant; it does not produce, however, any stimulating action. In larger doses, especially if recent, it acts upon the bowels. With a view to the effects mentioned, it is employed at the commencement of pulmonary affections; and sometimes by its use in combination with antiphlogistics an attack may be cut short. In rheumatism it has also proved serviceable. Dr. Chapman (*Elem. of Therap.* vol. i. p. 351) speaks of its certainty and permanency of operation. Dr. Eberle employed it in dysentery. The dose of the powder is \mathfrak{ss} to \mathfrak{ssj} . The form of administration best adapted to produce perspiration is decoction, made by boiling \mathfrak{ssj} in a quart of water, and administering \mathfrak{ssij} every two hours.

The *A. incarnata* and *A. syriaca* have a place in the Sec. List of the *U. S. Pharm.* The roots are employed, and produce the same effects on the system as the previous species, but to less extent. They are seldom or never used.—J. C.]

[Two species of *APOCYNUM* are used for medicinal purposes in the United States.

Sex. Syst.—PENTANDRIA DIGYNIA.

Gen. Char.—*Calyx* very small, five cleft, persistent. *Corolla* campanulate, half five-cleft, lobes revolute, furnished at base with five dentoid glands, alternating with the stamina. *Anthers* connivent, sagittate, cohering to the stigma by the middle. *Style* obsolete, stigma thick and acute. *Follicle* long and linear. *Seed* comose (Nuttall).

1. *A. ANDROSÆMIFOLIUM*.—Dog's bane, U. S. Secondary List.

¹ Merat and De Lencs. *Dict. Mat. Med.* t. vi. p. 316. *Pharmaceutical Journal*, vol. viii. p. 400, 1849.

² Christison, *Dispensatory*.

Sp. Char.—*Leaves* ovate, smooth, on both sides, cymes lateral and terminal, smooth; tube of the corolla longer than the calyx (Beck).

This is a common species, found in all parts of the country, from Canada to Georgia, on hill-sides, and in open woods in barren soil. It is perennial, herbaceous, generally four feet high, with a smooth stem, and covered with tough fibrous bark. The flowers are white, tinged with rose colour.

The part used is the root, which is large and lactescent, of a disagreeable bitter taste; of this

the active portion is the bark, which forms about two-thirds of it. Its constituents are, *bitter extractive, colouring principle, camouchoe, and volatile oil.*

It yields its properties to water and alcohol. Dr. Zollickoff obtained 198 grs. of alcoholic extract, and 28 grs. of watery extract, from 3249 grains of the cortical part.

The properties of this root are emetic and diaphoretic. In doses of 30 or 40 grs. it promptly induces vomiting, with slight preceding nausea, on which account it may be used in cases where it is merely requisite to evacuate the stomach, as no relaxation is induced. It may be also used with a view to its diaphoretic action, in doses of 5 or 10 grs. in combination with opium, but is inferior to *Ipecacuanha*. (Griffith, *Med. Essays*, vol. ii. p. 200.) Dr. Zollickoff states that it is tonic in doses of from 10 to 20 grs. and is "admirably calculated to improve the tone of the digestive apparatus." (*Journ. of Pharm.* vol. v. p. 254; from *Am. Journ. of Med. Science*.)

APOCYNUM CANNABINUM.—*Indian Hemp*, U.S. *Secondary List.*

Sp. Char.—*Stem* upright, herbaceous. *Leaves* oblong, tomentose beneath, cymes lateral, longer than the leaves.

The Indian hemp is a perennial plant, usually about two or three feet in height, having a red or brown stem and oblong ovate, somewhat pubescent leaves. The flowers are small and of a greenish white colour externally, and pink internally in paniculate cymes.

This species is also found in most parts of the United States, in waste and neglected places.

The root is the portion used in medicine; it is horizontal, extending to a great distance, of a deep brown colour, becoming darker by age, and when wounded pours forth a thick lactescent juice. When fresh it is nauseous, somewhat acrid, and permanently bitter, and possesses a disagreeable odour.

When dried, it is brittle and easily reduced to powder, which resembles that of *ipecacuanha*. It is composed of two portions, an external cortical portion, which is brown without, and white within, and a ligneous cord, which is of a yellowish white colour.

Griscom (*Journ. of Philada. College of Pharmacy*, vol. v. p. 136, from *Am. Journ. of Med. Science*), found it to contain tannin, gallic acid (?), gum, resin, wax, secula, bitter principle or *apocynin*, colouring matter, and woody fibre. Knapp also examined it with similar results.

The root of this plant is very potent in its effects on the animal economy. Dr. Griscom (*op. citat.*), states "that its first effect when taken into the stomach is that of producing nausea, if given in sufficient quantity, which need not be large, and if this be increased, vomiting will be the result." It also acts upon the bowels, giving rise to copious discharges. These effects are attended with a reduced frequency of the pulse. A general relaxation of the skin and perspiration follow these effects. In some of the cases observed by the gentleman mentioned, diarrhoea took place, but not so marked in some cases as others. "In three or four cases related, the urinary secretion, although somewhat increased in quantity, was not such as to be commensurate with the effect produced upon the disease by the exhibition of the medicine. In other instances, its diuretic operation has been more manifest, causing very profuse discharges of urine, and in a short time relieving the overloaded tissues of their burden." The disease in which it has been found most useful is dropsy.

Fig. 315.



Apocynum Cannabinum.

When the powder is taken into the nostrils, it acts as a sternutatory.

As an emetic, the dose of the powder is from 15 to 30 grains. The best form of exhibition is in decoction, made by boiling an ounce of the root in a pint of water; the dose is ʒij to ʒiv , two or three times daily. The watery extract will purge in doses of from 3 to 5 grs. In the treatment of cutaneous affections, the juice of the root or plant may be made use of as an application.

The bark affords a fibre, which may be used in the place of hemp.—J. C.]

ORDER XLVIII. OLEACEÆ, *Lindley*.—OLIVEWORTS.

OLEINEÆ, *R. Brown*.

CHARACTERS.—*Flowers* hermaphrodite, rarely diœcious. *Calyx* monophyllous, divided, 4-lobed or 4-toothed, persistent, inferior. *Corolla* hypogynous, monopetalous, 4-cleft, occasionally of 4 petals connected in pairs by the intervention of the filaments, sometimes absent; *astivation* somewhat valvate. [*Frazinus* is generally apetalous.] *Stamens* 2, alternate with the segments of the corolla or with the petals; anthers 2 celled, opening longitudinally. *Ovary* simple, without any hypogynous disk, 2 celled; the *cells* 2-seeded; the ovules pendulous and collateral; *style* 1 or 0; *stigma* bifid or undivided. *Fruit* drupaceous, berried, or capsula, often by abortion 1-seeded. *Seeds* with dense, fleshy, abundant albumen; *embryo* about half its length, straight; *cotyledons* foliaceous, partly asunder; *radicle* superior; *plumule* inconspicuous.—*Trees* or *shrubs*. *Branches* usually dichotomous, and ending abruptly by a conspicuous bud. *Leaves* opposite, simple, sometimes pinnated. *Flowers* in terminal or axillary racemes or panicles; the *pedicels* opposite with single bracts (*R. Brown*).

PROPERTIES.—Not very remarkable. The barks of some species are tonic and astringent. Manna is obtained from several species.

201. OLEA EUROPÆA, *Linn.*—THE EUROPEAN OLIVE.

Sez. Syst. Diandria, Monogynia.

(*Oleum è fructu expressum*, *L.*—Expressed oil of the pericarp, *E.*—The oil obtained from the pericarp, *D.*)

HISTORY.—Few vegetables have been so repeatedly noticed and enthusiastically described by the ancient writers as the olive-tree. In all ages it seems to have been adopted as the emblem of benignity and peace. It is frequently mentioned in the Bible;¹ the ancient Greeks² were well acquainted with it; and several products of it were employed in medicine by Hippocrates.³ Pliny⁴ is most diffuse in his account of it.

Pliny⁵ tells us, on the authority of Fenestella, that there were no olive-trees in Italy, Spain, and Africa, in the reign of Tarquinius Priscus, in the 173d year from the foundation of the city of Rome; that is, 580 years before Christ. The Phœnicians are said to have introduced the olive-tree into France 680 years before Christ. Near Terni, in the vale of the cascade of Marmora, is a plantation of very old trees, and supposed to be the same plants mentioned by Pliny, as growing there in the first century.⁶

BOTANY. *Gen. Char.*—*Calyx* short, campanulate, 4-toothed, rarely truncated. *Corolla* with a short tube, and a 4-partite plane spreading limb; rarely absent. *Stamens* 2, inserted in the lower part of the tube of the corolla, opposite, exerted; in the apetalous species hypogynous. *Ovary* 2-celled. *Ovules* 2 in each cell, pendulous from the apex of the septum. *Style* short, with a bifid stigma at the apex, or subcapitate. *Drupe* berried, with oily flesh and an osseous kernel; by abortion 2- and often 1-seeded. *Seeds* inverted; albumen fleshy; embryo inverted, straight, with foliaceous cotyledons (*De Cand.*).

Sp. Char.—Leaves oblong or lanceolate, quite entire, mucronate, above smooth, beneath leprous-hoary. Racemes axillary, while flowering somewhat erect, when in fruit nodding. Fruit ellipsoidal (*De Candolle*).

A long-lived tree of slow growth. Wood hard; used for cabinet-work. Leaves in

¹ As in *Gen.* viii. 11.

² *Dierbach, Arzneim. d. Hippokr.* p. 77.

³ *Hist. Nat. lib.* xv. cap. 1-8; and lib. xxiii. cap. 34-37, ed. Valp.

⁴ *Hist. Nat. lib.* xv. cap. 1, ed. Valp.

² *Homer, Od.* v. 477.

⁶ *Loudon, Encycl. Gardening.*

Fig. 316.

*Olea Europæa.*

1. Corolla. 2. Calyx. 3. Drupe.

at the apex, violet, blackish, reddish, or even white, with an austere taste, or rarely insipid, &c. &c. The subvariety *longifolia* is cultivated in the South of France, and is said to yield the best oil. The young fruit is also most esteemed when pickled. The subvariety *latifolia* is chiefly cultivated in Spain. Its fruit is almost twice the size of the Provence olive, or subvariety *longifolia*, but of a strong rank flavour; and the oil is too strong for most palates.²

DESCRIPTION.—The products of the olive-tree deserving of notice are the *resiniform exudation*, the *leaves*, and the *fruit*.

1. Resiniform exudation of the olive-tree (*resina oleæ*).—The older writers speak of the exudation from olive-trees, and which Dioscorides³ describes as the *tears of the Æthiopic olive* (*lacrymæ oleæ æthiopicæ*). In modern times, it has been improperly termed *olive gum* (*gummi oleæ*) or *Lecca gum*. Pelletier⁴ has analyzed it, and found that it consists of a *peculiar matter* (*olivile*), *brown resin* soluble in ether, and *benzoic acid*. It was formerly employed in medicine.

Olivile is white, inodorous, bitter, crystallizable, very soluble in boiling alcohol and in the alkalies, but very slightly so in water and ether. The crystals consist of $C^{22}H^{18}O^{10}, 2HO$. By heat they lose 2 HO.

2. Olive leaves (*folia oleæ*).—The leaves of the olive-tree have been analyzed by Pallas,⁵ who found in them a bitter acid principle, a black resin, a peculiar crystalline febrifuge substance, gum, chlorophyll, tannin, gallic acid, and mineral salts. They have been employed externally as astringents and antiseptics; internally, as tonics in intermittents.⁶

3. Fruit of the olive-trees; Olives (*fructus oleæ; oliva*).—The *preserved* or *pickled olives* (*olivæ conditæ*), so admired as a dessert, are the green unripe fruit, deprived of part of their bitterness by soaking them in water, and then preserved in an aromatized solution of salt. Several varieties are met with in commerce, but the most common are the *small French* or *Provence olive* and the *large Spanish olive*. Olives à la *picholine* have been soaked in a solution of lime and wood-ashes.⁷ Ripe olives are remarkable from the circumstance of their sarcocarp abounding in a bland fixed oil.

pairs, shortly petiolated, green above, hoary beneath. *Flowers* small and white. *Drupe* dark bluish-green; kernel hard, with usually only one ovule. The whitish character of the foliage gives a dull and monotonous appearance to countries where the olive is extensively cultivated, as Provence and Languedoc.¹

Hab.—Grows spontaneously in the East (Asia), from whence it has migrated into the South of Europe, the Mediterranean Islands, and the North of Africa, where it is extensively cultivated, and, by the dissemination of the seeds, now grows apparently wild.

Var. *α. Oleaster.* The Wild Olive.—Branches more or less indurated-spinescent, and more or less quadrangular. Leaves oblong or oval. Fruit smaller.—Grows wild in the whole of the olive region, especially in rocky places.

Var. *β. sativa.* The Cultivated Olive.—Branches unarmed, roundish. Leaves lanceolate. Racemes few-fruited.—Cultivated in the whole of the olive region.—There are numerous subvarieties, with the fruit ovate, ellipsoidal, or almost spherical, obtuse at the apex, submucronate or subincurved

¹ Sharp, *Letters from Italy*, Lond. 1768.² Lib. i. cap. 141.³ *Journ. de Pharm.* xiii. 604.⁴ Duhamel, *Traité des Arbres*, t. ii. p. 57.⁵ Don's *Gardener's Dictionary*, vol. iv. 47.⁶ *Ann. de Chim. Phys.* iii. 105, h. 196.Richard, *Elém. d'Hist. Nat.* t. ii. p. 21.

EXPRESSION OF OLIVE OIL.—The process of procuring olive oil is somewhat modified in different countries, though the principle is the same in all.

In Spain, the olives are pressed by conical iron rollers elevated above the stage or floor, round which they move on two little margins to prevent the kernel being injured, the oil from which is said to have an unpleasant flavour. Spanish olive oil, however, is inferior to other kinds, from the circumstance of the time which elapses between the gathering and the grinding of the olives. This arises from the number of mills not being in proportion to the quantity of fruit to be ground; so that the olives are placed in heaps to wait their turn, and in consequence often undergo decomposition.¹

In France, the finest oil is procured by bruising the fruit in the mill, immediately they are gathered, and then submitting the paste to pressure. The first product has a greenish tint, and is termed *virgin oil* (*oleum olivarum virginicum*; *huile vierge*). The cake or *marc* is removed from the press, broken up with the hand, moistened with boiling water, and re-pressed. The products are water and oil of a *second quality*; these separate by standing. The cake, which is left, is termed *grignon*, and is employed by some as fuel; others, however, ferment it, and, by the aid of boiling water, obtain a very inferior oil, called *gorgon*, which is employed either for soap-making or burning in lamps.²

With the view of increasing the quantity of oil, some persons allow the olives to undergo incipient fermentation, which breaks down the parenchyma of the fruit before they are pressed; but the quality of the oil is thereby injured. Guibourt³ tells us that it is a yellow, but a mild and agreeable oil, and is much used for the table.

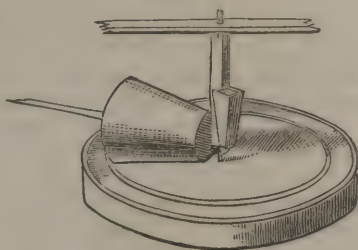
The machinery employed by the Neapolitan peasants in the preparation of the Gallipoli oil is of the rudest kind. The olives are allowed to drop in their maturity from the tree on the ground, where they are picked up chiefly by women and children, and carried to the mill. The oil, when expressed, is sent, in sheep or goat skins, carried on mules, to Gallipoli, where it is allowed to clarify in cisterns cut in the rock on which the town is built. From these it is conveyed, in uteri or skins, to basins near the sea-shore; and from these basins the oil casks are filled.⁴

According to Sieuve,⁵ 100 lbs. of olives yield about 32 lbs. of oil; 21 of which come from the pericarp, 4 from the seed, and 7 from the woody matter of the nut (*pyrena*). That obtained from the pericarp is of the finest quality.

Recently-drawn olive-oil deposits, by standing, a white fibrous matter, which the ancients employed in medicine under the name of *amurca*.⁶

PROPERTIES OF OLIVE OIL.—Olive oil (*oleum olivæ seu olivarum*; *sweet oil*) is an unctuous fluid of a pale yellow or greenish-yellow colour. When of good quality it has scarcely any smell. Its taste is bland and mild. Its sp. gr. is probably not uniform; and hence the discrepancies in the experimental results of different chemists. Saussure makes it 0.9192 at 53°.6 F., and 0.9109 at 77° F.; Meidenrich says it is 0.9176 at 59° F. In cold weather it deposits white fatty globules (a combination of *elaine* and *margarine*). At about the freezing point of water it congeals. It is soluble in about 1½ times its weight of ether; but is very slightly soluble in alcohol. By admixture with castor oil, its solubility in rectified spirit is augmented (see *ante*, p. 376). Pure olive oil has less tendency to become

Fig. 317.



Spanish Olive Oil Mill.

¹ Dillon, *Travels through Spain*, p. 343, 1782; Jacob, *Travels in Spain*, p. 149, 1811.

² Duhamel, *Traité des Arbr. Fruit.* t. ii. pp. 71–2.

³ M'Culloch's *Dict. of Commerce*.

⁴ Pliny, *Hist. Nat. lib. xv. cap. iii. ed. Vulp*

⁵ *Hist. des Drog.* t. ii. p. 339.

⁶ De Candolle, *Phys. Vég.* p. 299.

rancid by exposure to the air than most other fixed oils; but the second qualities readily acquire rancidity. This seems to depend on the presence of some foreign matter. Olive oil is not a drying oil, and, being less apt than many oils to increase in consistence by exposure to air, is preferred for greasing delicate machinery, and especially watch and clock-work. To prepare it for the latter application, the oil is cooled, and the more liquid portion poured off from the fatty deposit. A piece of sheet lead, or some shot are then immersed in it, and it is exposed in a corked phial to the action of sunshine. A white matter gradually separates, after which the oil becomes clear and colourless, and is fit for use (Brande).

VARIETIES.—*Provence oil* (*oleum provinciale*), the produce of Aix, is the most esteemed. *Florence oil* is a very fine kind of olive oil, imported from Leghorn, in flasks surrounded by a kind of network formed by the leaves of a monocotyledonous plant, and packed in half-chests; it is used at the table, under the name of *salad oil*. *Lucca oil* is imported in jars holding nineteen gallons each. *Genoa oil* is another fine kind. *Gallipoli oil* forms the largest portion of the olive oil brought to England; it is imported in casks. Apulia and Calabria are the provinces of Naples most celebrated for its production; the Apulian is the best. *Sicily oil* is of inferior quality; it is principally produced at Milazzo. *Spanish oil* is the worst. The foot deposited by olive oil is used for oiling machinery, under the name of *droppings of sweet oil*.

ADULTERATION.—Olive oil is liable to adulteration with some of the cheaper fixed oils, as with poppy oil, lard oil,¹ &c. Various tests have been proposed for the detection of the fraud, but none of them are very accurate or to be absolutely relied on, partly, perhaps, because olive oil itself is not uniform in its qualities.

The following are some of the proposed tests: 1st. Expose a few drops of the oil, in a porcelain vessel, to the heat of a lamp for a few seconds, and examine the odour of the vapour; the presence of foreign oils may be detected by their peculiar smell.² 2dly. The sp. gr. of the oil may be determined by Goble's *elaiometer*, whose zero is the point at which the instrument floats in poppy oil, and its 50° the point at which it floats in olive oil.³ 3dly. If we shake pure olive oil in a phial half filled with it, the surface of the oil soon becomes smooth by repose; whereas, when poppy oil is present, a number of air-bubbles (or *beads*, as they are termed) remain. 4thly. Olive oil is completely solidified when cooled by ice; poppy oil, however, remains in part liquid. Even two parts of olive oil to one of poppy oil will not completely congeal.⁴ 5thly. Olive oil, according to Rousseau,⁵ conducts electricity 675 times worse than other vegetable oils. The addition of two drops of poppy or beech-nut oil to 154½ grains of olive oil is sufficient to quadruple the conducting power of the latter. To ascertain the conducting power of oil, Rousseau used the *electrical diagraph* (from *διάγωω*, to conduct; and *μέτρον*, to measure). It consists of one of Zamboni's dry piles and a feebly-magnetized needle, moving freely on a pivot. The electricity developed by the pile produces a deviation in the direction of the needle; but when any substance is interposed between the needle and the pile, the deviation is less in proportion to the bad conducting power of the interposed substance. 6thly. If recently-made nitrate of mercury (prepared by dissolving 6 parts of mercury in 7.5 parts of nitric acid, sp. gr. 1.36) be mixed with twelve times its weight of pure olive oil, and the mixture strongly agitated, the whole mass becomes solid in the course of a few hours; this, however, does not occur with adulterated oil. We judge of the presence and quantity of foreign oils by the degree and quickness of solidification of the suspected olive oil.

"When carefully mixed with a twelfth of its volume of solution of nitrate of mercury prepared as for the Unguentum Citrinum (see vol. i. p. 819), it becomes in three or four hours like a firm fat, without any separation of liquid oil."—*Ph. Ed.*

COMPOSITION.—In 1808, Gay-Lussac and Thenard⁶ examined the ultimate composition of this oil. In 1815, Braconnet⁷ ascertained the proximate constituents of it; and subsequently Saussure⁸ examined the ultimate composition of these constituents.

¹ *Pharmaceutical Journal*, vol. x. p. 132, 1850.

² Heidenreich, *Chemical Gazette*, vol. i. p. 322, 1843.

³ *Journal de Pharm. et de Chim.* 3me sér. t. iv. p. 255, 1843; *Pharmaceutical Journal*, vol. iv. p. 403, 1845.

⁴ Guibourt, *Hist. des Drog.* t. ii. p. 603.

⁵ *Rech. Phys. Chim.* ii. 320.

⁶ *Ann. de Chim. et Phys.* t. xiii. p. 349.

⁷ *Journ. de Pharm.* t. ix. p. 557.

⁸ *Ann. de Chim.* xciii. 240.

PROXIMATE ANALYSIS.		ULTIMATE ANALYSES.			
<i>Braconnot's.</i>		<i>Gay-Lussac and Thénard's.</i>		<i>Saussure's.</i>	
Elaine (oleine)	72	Carbon	77.213	76.034	82.170
Margarine	28	Hydrogen	13.360	11.515	11.232
		Oxygen	9.427	12.068	6.302
		Nitrogen	0.000	0.353	0.296
Olive oil	100	Olive oil	100.000	Elaine 100.000	Margarine 100.000

1. **ELAINE or OLEINE.**—Braconnot obtained it by exposing olive oil to a temperature of about 21° F., in order to cause the congelation of the margarine. The Elaine was a greenish yellow liquid; at 14° F. it deposited a little margarine.

2. **MARGARINE.**—The solid matter of olive and other vegetable oils, obtained as above, is usually denominated *stearine*, but Lecanu¹ has pointed out several characters by which it is distinguished from that principle; thus, it is more fusible, and is much more soluble in cold ether. In most other respects it agrees with *stearine*.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Olive oil, as well as other fixed oils, acts injuriously on the roots of plants, by obstructing their pores and meatus, and preventing the passage of water.²

β. On Animals.—Injected into the veins, the fixed oils prove injurious by their mechanical operation. They obstruct the circulation in the capillary vessels, and in this way cause death. Both Courten and Hertwich³ have destroyed dogs by injecting half an ounce of olive oil into the veins.

γ. On Man.—The fixed oils are extremely nutritious, but they are difficult of digestion, and hence are apt to disagree with dyspeptics. Some writers (as Dr. Dunglison⁴) are of opinion that, taken as a condiment, with salad, oil promotes the digestibility of the latter; but this notion is probably unfounded; for salad is not usually obnoxious to the digestive organs, whereas, oil frequently is so. Swallowed in large doses, olive oil acts as a laxative, in general, without occasioning pain.

USES.—In England, the *dietetical* uses of olive oil are very limited, being principally confined to its mixture with salads. In Spain, and some other countries, it is frequently employed as a substitute for butter. Dyspeptics should carefully avoid its use.

Medicinally it is not often administered by the mouth. As a *mild laxative* it may be used in irritation, inflammation, or spasm of the alimentary canal, or of the urino-genital organs. As an *emollient* and *demulcent* it is used to involve acrid and corrosive substances, and sheathe the stomach from their action; and taken in the form of emulsion (made with gum, albumen, or alkali) it is used to allay troublesome and spasmodic cough in pulmonary and bronchial irritation, &c.; but in such cases almond oil is generally preferred.

As an *antidote*, it has been used in mineral, animal, and vegetable poisoning; but its operation appears to be entirely mechanical (see *Mechanical Antidotes*, p. 198.) It envelops the poison, sheaths the living surface, and mechanically obstructs absorption. At one time it was supposed to possess antidotal properties for arsenical poisons; and Dr. Paris⁵ tells us, that the antidote on which the men employed in the copper-smelting works and tin-burning houses in Cornwall, rely with confidence, "whenever they are infested with more than an ordinary portion of arsenical vapour, is sweet oil; and an annual sum is allowed by the proprietors, in order that it may be constantly supplied." Oil was formerly recommended as an antidote for cantharides; but the discovery of the solubility of cantharidin in oil has led to the suspicion, that, instead of alleviating, it might increase the patient's danger. There is no just ground for supposing that oil, applied externally, or taken internally, has any particular influence in counteracting the operation or relieving the effects of the poison of venomous serpents, notwithstanding the high encomiums that have been passed on it. As an *anthelmintic*, olive oil is occasionally used.

Olive oil is a frequent constituent of *laxative enemata*, especially in dysentery, or irritation of the bowels or of the neighbouring viscera.

¹ *Ibid.* iv. 204.

² Wilmmer, *Wirk. d. Arzneim. u. Gifte*. Bd. iv. S. 9.

³ *Pharmacol.* 6th edit. vol. i. p. 97.

⁴ De Candolle, *Phys. Vég.* p. 1347.

⁵ *Elem. of Hygiène*, p. 269.

Externally, it is used in the form of *liniment* (as the *linimentum ammoniac* and *linimentum ammoniac sesquicarbonatis*; see vol. i. pp. 433 and 442). Smearcd over the body, it has been recommended by Berchtold and others¹ as a safeguard against the plague. It can be beneficial only by mechanically impeding absorption.

It may be employed also to relax the skin and sheathe irritable surfaces. Frictions of olive oil have been employed in ascites and anasarca.

In *pharmacy*, olive oil has been employed in the preparation of *liniments*, *ointments*, *cerates*, and *plasters*. It serves for making both a hard and a soft soap used in medicine (see *ante*, pp. 550—551); and is one source of *glycerine*. In *surgery*, it is used for besmearing surgical instruments, as bougies, &c.

ADMINISTRATION.—The dose of olive oil as a laxative is from $\text{f}\overline{3}\text{j}$ to $\text{f}\overline{3}\text{ij}$.

202. FRAXINUS ROTUNDIFOLIA, Linn.; et F. ORNUS, Lam.

Sex. Syst. Diandria, Monogynia.

(Succus ex inciso cortice fusus, dere induratus, L.—Sweet concrete exudation, probably from several species of *Fraxinus* and *Ornus*, E.—An exudation from *Fr. Ornus* and other species, constitutes the manna of commerce, D.)

HISTORY.—Although these two species of manna ash must have been known to the ancients, yet no notice is taken of the manna which they yield. It is difficult, however, to believe that they were unacquainted with it. The earliest writer who distinctly mentions it is Johannes Actuarius.²

It has been presumed that, under the names of *honey-dew* ($\delta\rho\omicron\sigma\omicron\mu\epsilon\lambda\iota$, *mel roscidum*), *honey-air* or *aerial honey* ($\alpha\epsilon\rho\omicron\mu\epsilon\lambda\iota$, *mel aerium*), and *honey-oil* ($\epsilon\lambda\epsilon\omicron\mu\epsilon\lambda\iota$, *elæomeli*), the ancients included our manna.

The nature of the substance which, in our translation of the Old Testament,³ is called manna (*man*, literally *what is it?*) is quite unknown. By some it has been thought to be the manna of the Tamarisk (*Tamarix mannifera*); by others, the manna of the Camel's Thorn (*Alhagi maurorum*). But neither these nor any other known sorts of manna explain the manna of Scripture, "by which abundance is stated to have been produced for millions, where hundreds cannot now be subsisted."⁴

BOTANY. *Gen. Char.*—*Flowers* polygamous or diœcious. *Calyx* 4-leaf or none. *Petals* either none or 4, usually in pairs, cohering at the base, oblong or linear. *Stamens* 2. *Stigma* bifid. *Fruit* (samara) 2-celled, compressed, winged at the apex, with 2 ovules in each cell, or by abortion 1-seeded. *Seeds* pendulous, compressed; albumen fleshy, thin; embryo longitudinal; cotyledons elliptical; radicle linear, superior (De Cand.).

Species. 1. *FR. ORNUS*, Linn.; *Ornus Europæa*, Persoon; *Μελία*, Dioscorides, lib. i. cap. 108; *European Flowering* or *Manna Ash*.—Leaflets 3—4 pairs, subpetiolate, lanceolate, attenuated at both extremities, serrated at the apex, entire at the base, bearded beneath near the nerve. Buds velvety. Panicles crowded, shorter than the leaf. Fruits narrow, linear-lanceolate, obtuse, attenuated at both extremities (De Cand.).

A small tree (20—25 feet high). *Leaves* opposite, large, pinnate. *Leaflets* large. *Panicles* large and many-flowered. *Flowers* small and polygamous. *Corolla* yellowish or greenish white. *Fruit* flat, wedge-shaped, smooth, winged.

South of Europe, in mountainous situations; especially Calabria and Sicily. De Candolle says that it rarely produces manna in Calabria.

2. *F. ROTUNDIFOLIA*, Lamarck; *Ornus rotundifolia*, Persoon; *Μελία ῥοῦνδύλη*, Theophrastus, Hist. Pl. lib. iii. cap. 11; *Round-leaved, Flowering, or Manna Ash*.—Leaflets, 2—4 pairs, smooth, ovate or roundish, obtusely serrate, subsessile, minutely reticulate. Petioles channelled. Buds brown externally,

¹ Hufeland's Journal. Bd. vi. S. 437; and Bd. xii. St. iii. S. 153.

² Friend's Hist. of Physick. i. 271.

³ Kitto's Cyclop. of Bibl. Literature, vol. ii. p. 293.

⁴ Exod. xvi. 14, 15, 31, and 33; Numt. xi. 7.

somewhat velvety (De Cand.).—A small tree (16 to 20 feet high). By some botanists considered to be a variety of the preceding species. Grows in Calabria and the East. De Candolle says that from this tree manna is chiefly obtained.

EXTRACTION OF MANNA.—Manna is obtained both in Calabria¹ and Sicily by incision into the stem of the trees. The mode of obtaining Sicilian manna has been described by Houel,² and more recently by Stettner,³ who made his observations during the summer of 1847. In the manna districts of Capace, Cinesi, and Fabaretto, in Sicily, where the best manna is obtained, the *Fraxinus Ornus* is cultivated in separate square plantations. The trees are not tapped till they cease to produce more leaves, which happens about July or August. Cross or transverse incisions, about two inches long, are made in the stem by means of a hooked or curved knife, beginning at the lower part, near the soil, and are repeated daily in warm weather, extending them perpendicularly upwards, so as to leave the stems uninjured on one side, which is cut next year. In the lowermost sections, small leaves of the ash are inserted to conduct the juice into a receptacle formed by a leaf of *Opuntia*. In this way is obtained *manna in sorts* (called *Capace* or *Gerace manna*). The *flake manna*, preferred by the English, is obtained during the height of the season, when the juice flows vigorously (Houel). It is procured from the upper incisions; the juice there being less fatty than that in the lower part, and, consequently, it more easily dries in tubes and flat pieces (Stettner). The masses left adhering to the stems after the removal of the inserted leaves are scraped off, and constitute the *cannulated manna in fragments*. Although all three kinds of manna are got from the same stem, yet the younger stems yield more of the cannulated sort, and the older ones more of the fatty kind. Dry and warm weather are necessary for a good harvest.

DESCRIPTION.—Several kinds of (*manna*) are described by pharmacologists.

1. The finest of English commerce is called *flake manna* (*manna cannulata* vel *M. canellata*). It is imported in deal boxes, having partitions, and frequently lined with tin-plate. It consists of pieces of from one to six inches long, one or two inches wide, and from half an inch to an inch thick. Their form is irregular, but more or less stalactitic; most of the pieces being flattened or slightly hollowed out on one side (where they adhered to the tree or substance on which they concreted), and on this side they are frequently soiled. Their colour is white, or yellowish-white; they are light, porous, and friable; the fractured surface presents a number of very small capillary crystals. The odour is somewhat like that of honey, and is to me rather unpleasant; the taste is sweet, but afterwards rather acrid.

Fig. 318.



Extraction of Manna.

- | | |
|-------------------------------|----------------------------|
| a. Stem of the tree. | c. Incision. |
| b. Leaf of the <i>Ornus</i> . | d. Leaf of the Indian fig. |
| | e. Hooked knife. |

In the right hand of each of the collectors is a box to contain the manna, which is afterwards transferred to a basket.

¹ Cirillo. *Phil. Trans.* vol. ix. p. 233.

² *Voy. Pittoresq. de Sicile*, &c. t. i. pp. 52—3, 1732.

³ Hooker's *Journ. of Botany*, vol. i. p. 124, 1849; and *Pharm. Journal*, vol. ix. p. 283, 1849.

2. Under the name of *Sicilian Tolfa manna* I have received an inferior kind, corresponding to the *manna in sorts* (*manna in sortis*) of some pharmacologists. From its name I presume it is brought from Sicily, and that it corresponds in quality to Tolfa manna, produced near Civita-Vecchia, and which Fée¹ states is but little valued. The Sicilian Tolfa manna occurs in small pieces, which seldom exceed an inch in length; some of these present the same appearances, with respect to consistence, colour, friability, and crystalline appearance, as the flake manna; others, however, are soft, viscid, brownish, and uncrystallized, like those of the next variety.

3. The commonest kind of English commerce is called *Sicilian manna* (*manna siciliana*). It appears to me to be the *common* or *fatty manna* (*manna pinguis*) of some writers. It consists of small, soft, viscid fragments, of a dirty yellowish-brown colour, intermixed with some few dark-coloured small pieces of the flake variety. It contains many impurities intermixed.

A sort of manna, called *manna foliata*, or *manna de fronde*, is produced on the leaves of the manna ash, by the punctures of a small hemipterous insect² (*Cicada Orni*, Linn.; *Tettigonia Orni*, Fabric).

The term *manna* is also applied to several other saccharine substances obtained from plants, but which are entirely different from the manna of the shops. The following are some of them: 1st, *Manna of Briançon* (*manna brigantina*) or *manna of the larch* (*manna laricis*) [see *ante*, p. 286]; 2dly, *Persian manna* (*manna persica*) or *manna of the Camel's thorn* (*manna alhagi*) [see *ante*, p. 560]; 3dly, *Tunarsik manna* (*manna tamariscina*), supposed by some to be the manna alluded to by Moses, and hence termed *manna mosaica* vel *m. judaorum* [see *ante*, p. 560]; and 4thly, *Oak manna* (*manna quercea*) [see *ante*, p. 317].

ADULTERATION.—In 1842, more than a ton of a fictitious manna was offered for sale in Paris. It appears to have been potato sugar. It was distinguished from genuine manna by its general appearance; its granular fracture; its taste, which was that of caramelized sugar, followed by a slight bitterness; its non-inflammability in the candle, its more marked fermentation when its aqueous solution was mixed with yeast, and the residual liquor not yielding mannite; its containing sulphate of lime; and its property of circular polarization³ (see *ante*, p. 150).

COMMERCE.—Manna is imported into this country principally from Palermo and Messina. It is also occasionally brought from other ports of Sicily; viz. Licata, Girgenti, Catania, Terra Nova, and Marsala. Farthermore, Naples, Leghorn, Trieste, Genoa, and Marseilles, are other places of shipment of it.

COMPOSITION.—Manna was analyzed in 1809 by Bucholz,⁴ and in 1845 by Leuchtweiss.⁵

BUCHOLZ'S ANALYSIS.		LEUCHTWEISS'S ANALYSES.			
	<i>Manna canelata.</i>		<i>M. canelata.</i>	<i>M. canel. in fragmentis.</i>	<i>M. calabr.</i>
Mannite	60.0	Mannite	42.6	37.6	32.0
Fermentable but uncrystallizable sugar with colouring matter (purgative bitter matter?)	5.5	Sugar	9.1	10.3	15.0
Sweetish gum	1.5	Mucilage, with some mannite, resinous and acid matter, and a small quantity of a nitrogenous substance	40.0	40.8	42.1
Gummy extractive	0.8	Insoluble matter	0.4	0.9	3.2
Fibro-glutinous matter	0.2	Water	11.6	13.0	11.1
Water and loss	30.0	Ashes	1.3	1.9	1.9
	98.0		105.0	104.5	105.3

1. **MANNITE** (*Mannitum*); *Manna Sugar*; *Grenadin*. Formula $C^6H^{10}O_4 \cdot 2HO$. Eq. Wt. 91.—It is a constituent of manna. It may also be obtained by exciting the viscous fermentation in a solution of ordinary sugar. It may be procured from beet-root (see *ante*, p. 438), dandelion-root,⁶ sea-weeds (see *ante*, p. 50), &c.—It is most readily and economically obtained from

¹ *Cours d'Hist. Nat.* ii. 366.

² De Candolle, *Physiol. Végét.* t. i. p. 238; Brandt u. Ratzeburg, *Med. Zoologie*, Bd. ii. p. 211.

³ *Journ. de Pharm. et. Chim.* 3me sér. t. i. pp. 58 and 154, 1842; and *Pharmaceutical Journal*, vol. ii. p. 222, 1843.

⁴ *Taschenbuch für Scheidekunst*, 1809; and *Berlin. Jahrbuch für d. Pharm.* p. lxi. 1809.

⁵ *Annal. der Chemie u. Pharm.* Bd. liii. S. 124, 1845.

⁶ Messrs. T. and H. Smith, *Pharmaceutical Journal*, vol. v. iii. p. 480, 1849.

manna by Ruspini's process:¹ Common manna is first prepared by melting it over the fire in distilled or rain water, in which the white of egg has been previously beaten; boil and strain the solution through a linen cloth; the strained liquor solidifies on cooling. Submit the prepared manna to strong pressure, then mix it with its own weight of cold water, and again press it. Dissolve the pressed cake in boiling water, add animal charcoal, and then filter and evaporate the solution, which is then to be set aside to crystallize.—Mannite is a white, crystalline, odourless substance, which has a sweet agreeable taste. It is soluble in 5 parts of cold water, and in a smaller proportion of boiling water; it is readily soluble in boiling alcohol, but less so in cold alcohol. It is essentially distinguished from sugars strictly so-called (see *ante*, p. 149) by two characters: 1st, its solution does not undergo the vinous fermentation when in contact with yeast (see *ante*, pp. 86 and 149); 2dly, its solution does not possess the property of rotatory polarization (see *ante*, pp. 150 and 293).—Mannite has recently been imported from Italy in the form of beautiful white crystalline conical masses, which are totally devoid of any disagreeable flavour.² It is intended to be a substitute for common manna.

2. RESIN.—Manna contains a resin which has a disagreeable odour, and a nauseous, irritating, unpleasant flavour. The quantity of it, however, is very inconsiderable. Is this the *purgative principle* of manna? It is usually accompanied by an acid, whose solution, by evaporation, is gradually converted into resin.

PHYSIOLOGICAL EFFECTS. *a. On animals generally.*—In moderate doses manna is nutritive, and is greedily devoured by some animals. Thus, Swinburn³ tells us that vipers and martens are very fond of it. In large doses it acts as a mild laxative. The dose for carnivorous animals is about two ounces dissolved in broth or milk.⁴ It is rarely given to horses, on account of the large dose required.

β. On Man.—It has an analogous operation on man; that is, in small doses it is nutritive, and in large ones mildly laxative. It acts on the bowels without exciting vascular irritation, and is, therefore, admissible in inflammatory cases. It is apt, however, to produce flatulence and griping. The fresher and less changed the manna, the feebler are said to be its laxative powers; and hence the Calabrians are enabled to use it frequently as an article of food. When by keeping and partial decomposition it has acquired an increase of laxative powers, it is less easily digested, and is more apt to excite flatulence. Hence, also, we are told, the commoner kinds of manna are more laxative and more apt to disagree with the stomach than the finer varieties. The older writers imagined that manna promoted the secretion of bile. Manna approaches tamarinds as a laxative, but it is more nutritive and less refrigerant, in consequence of possessing more mucilaginous and saccharine matter, and less free vegetable acids.

USES.—It is employed as a laxative, partly on account of the mildness of its operation, partly for its sweet flavour, in delicate persons, as females and children. Dr Burns⁵ recommends it for new-born infants, if the meconium do not come away freely. On account of its sweetness it is frequently added to flavour purgative draughts, and is used as a common laxative for children, who readily eat it.

ADMINISTRATION.—It may be taken in substance or dissolved in warm milk or water.—The dose, for an adult, is from ʒj to ʒij; for children, from ʒj to ʒiij.

ORDER XLIX. STYRACACEÆ, *Alph. DC.*—STORAXWORTS.

CHARACTERS.—*Calyx* 5- and very rarely 4-lobed; the lobes quincuncial in æstivation. *Corolla* 5- very rarely 4 or 6—7-lobed, consisting of 5 or 4—7 petals usually but slightly connate at the base, campanulate or subrotate, sometimes an inner whorl of petals concrete to the tube of the outer and alternating with the lobes. *Stamens* adnate to the base of the corolla, free or connate by the filaments, in 1 or many rows; either 8—10, alternate and opposite to the lobes of the corolla, or indefinite, free, pentadelphous or monadelphous, adelphous or longer stamina alternating with the lobes of the corolla; *anthers* 2-celled, dehiscing laterally or inwardly, shorter than the filament; *pollen* broadly elliptical, smooth. *Nectary* 0. *Ovary* inferior or semi-inferior, rarely free, 5—2-celled; the cells opposite the lobes of the calyx when they are of the same number; the partitions sometimes scarcely adhering in the centre of the ovary. *Ovules* 2 or

¹ *Pharmaceutical Journal*, vol. vi. p. 183, 1846.

² *Travels in the Two Sicilies*, 1795.

³ *Principles of Midwifery*.

⁴ *Ibid.* vol. ix. pp. 349 and 453, 1850.

⁵ Moiroud, *Pharm. Vét.*

indefinite in each cell, all pendulous, or the upper ones erect and the lower pendulous, always anatropal. *Style* simple. *Stigma* somewhat capitate. *Fruit* usually baccate, rarely dry, more rarely dehiscing, surmounted by the erect lobes of the calyx, oblong or subglobose, all the cells but one with abortive ovules. *Seeds* 5—1, usually solitary, erect, horizontal or often pendulous, albuminous. *Embryo* lying in the axis of the albumen; cotyledons flat, never longer than the radicle.—*Trees or shrubs*. *Leaves* alternate, simple, without stipules. *Racemes or solitary flowers*, axillary, with bracts (Alp. De Cand.).

PROPERTIES.—Storax and Benjamin, obtained from the genus *Styrax*, are well-known stimulant balsamic resins. *Symplocos Alstonia* is used at Santa-Fé as tea. The properties of the other species are but little known.

203. STYRAX OFFICINALE, Linn.—THE OFFICINAL STORAX.

Sex. Syst. Decandria, Monogynia.

(*Planta incerta*, *Balsamum liquidum*, *L.*—Balsamic exudation, *E.*—Resina, *D.*).

HISTORY.—Storax, as well as the tree producing it, was known to the ancient Greeks and Romans; by the former it was called *στίραξ*, by the latter *styrax*. It is mentioned by Hippocrates,¹ Theophrastus², Dioscorides,³ and Pliny.⁴

BOTANY. **Gen. Char.**—*Calyx* urceolate-campanulate, 5-toothed at the apex or nearly entire. *Corolla* monopetalous, 5-partite, rarely and perhaps by monstrosity 4- or 6—7-partite, twice or thrice the length of the calyx, with lanceolate or oblong lobes, externally whitish tomentose. *Stamens* 10, rarely variable 7—12, connate to the base of the corolla, alternate and opposite to its lobes, almost equal; *filaments* connate at the base in a short tube, distinct at the apex, hairy especially internally; *anthers* erect, linear, continuous with the filament, 2-celled, dehiscing inwards by longitudinal slits. *Ovary* adherent at the base, ovoid, pubescent, 3-celled; the partitions incomplete. *Ovules* indefinite. *Style* filiform. *Stigma* almost 3-lobed. *Fruit* globose or ovoid, adnate to the base of the persistent calyx, pubescent, 1-celled, 1-seeded, rarely 2—3-seeded. *Seed* in general solitary, marked by lines caused by the impression of the walls of the pericarp; the hilum round, inferior and sublateral; *albumen* fleshy; *cotyledons* ovate-rounded, as long as the radicle (Alp. De Cand.).

Sp. Char.—Leaves oval-obovate, on the upper surface smoothish, beneath, hoary tomentose. *Racemes* few-flowered. *Pedicels* longer than the abbreviated peduncle, subternate terminal, and, as well as the calyx, hoary (Alp. De Cand.).

A small tree. *Stem* about 20 feet high; bark smooth. Younger branches hoary. *Leaves* alternate, petiolated, usually rounded at the apex, entire. *Racemes* axillary and terminal, shorter than the leaf, of from 3 to 5 flowers. *Calyx* almost hemispherical, with 5 short marginal teeth. *Corolla* white, externally hoary, with 6-7 segments. *Fruit* (capsule, Nees) coriaceous, downy, usually with 1 seed.

Hab.—The Levant, Palestine, Syria, Greece. Cultivated in the southern parts of Europe.

DESCRIPTION.—In England, two sorts of storax are met with in the shops, and are used in medicine; these are *liquid storax*, and what is usually called *styrax calamita*.

1. *Styrax liquida* (*Liquid Storax*).—The following is the mode of obtaining this substance according to Landerer⁵ :—

“The storax plant, *Styrax officinalis*, is found in different parts of continental Greece, as well as in some of the islands of the Archipelago. It is there only a small shrub, and does not possess the agreeable odour which botanists ascribe to it. The bark of the tree growing in Greece has not the slightest odour—in consequence, probably, of the neglect of cultivation. It is very different, however, with the plant growing in the Turkish Islands, Cos and Rhodes, especially that cultivated by the inhabitants of Cos.—At Cos and Rhodes the plant is called *βουχούζι*. At the flowering season, it fills the air with its delightful vanilla-like perfume. At

¹ *De Nat. Mul.* pp. 575 and 587, ed. Fæs.

² *Hist. Plant.* lib. ix. cap. 7.

³ *Lib. i.* cap. lxxix.

⁴ *Hist. Nat.* lib. xii. cap. 40 and 45, ed. Valp.

⁵ Buchner's *Repertorium*, 2te Reihe, Bd. xviii. p. 359, 1830; also, *Pharm. Central-Blatt* für 1840, p. 11.

the season of the collection of the bark and of the young branches which are employed in the preparation of *Buchuri-Jag*—that is, of *storax oil* (oil being called in Turkish *Jag*)—a license is obtained from the Pasha residing at Rhodes, and for which a small sum is paid as a tax. The persons who have thus been licensed make, with small knives, longitudinal incisions, and separate the fresh pieces of bark from the stem in the form of small narrow strips. These easily stick together on account of their glutinous juice. In this way are obtained masses of one *oka* (about 2 lbs.) each, which are either preserved for the preparation of *jag*, or are immediately purchased by Rhodian merchants and sent to Rhodes.

The preparation of *Buchuri-jag* is effected, not by boiling, but merely by pressing the above-mentioned masses in presses somewhat warmed, and which are termed *styraki*. The *jag* obtained by slight pressure has an unctuous consistence, a light gray colour, and evolves an agreeable vanilla-like odour. This is the only kind which is exported; but they also use it at Cos and Rhodes for the preparation of an agreeable-smelling mass, and for that purpose add to it finely powdered olibanum, and therewith form cakes of about the size of a small fist, which they also call *styrakia*. The preparation of this substance is exclusively effected by monastic clergy, who mark their produce with the monastic seal. By repeated warming and greater pressure, an almost black *buchuri-jag* is obtained, and which is used by the natives for the preparation of salves and medicines. The pieces of bark which are left behind after the expression of the juice are tied together and sent in part to Constantinople and in part to Syria, where they are used for fumigating.

With respect to the decoction of the bark and the adulteration of storax with turpentine, the Rhodian merchants, from whom these accounts were obtained, declared that they were ignorant of the mode of effecting it, and that the adulteration with turpentine, if discovered, carries with it the penalty of death.¹

I have met with two kinds of liquid storax in the shops; one which is opaque (*common or opaque liquid styrax*), and another which is pellucid or transparent (*pellucid liquid storax*).

a. Common or Opaque Liquid Storax; Impure or Coarse Liquid Storax, Hill. —This is imported from Trieste in casks or barrels holding about 4 cwt. each. It is opaque, of a gray colour, has the consistence of birdlime and the odour of storax, but frequently intermixed with a feeble odour of benzole or naphthaline.

The substance met with in the shops, and sold to perfumers under the name of *strained storax* (*styrax colatus*), is prepared from liquid storax by heating it until the water with which it is usually mixed is evaporated, and then straining it. During the process it evolves a very fragrant odour. The impurities are stones, sand, &c.

In consequence of Petiver's statement¹ before alluded to (see *ante*, p. 313), liquid storax has been supposed to be the produce of a species of *Liquidambar*, probably *L. Altingia* or *L. orientale*. But several reasons are unfavourable to this opinion: 1st. Its vanilla-like odour allies it to the products of *Styrax officinale*, and at the same time separates it from all authentic products of the genus *Liquidambar*. Dr. Wood,² for example, found the genuine juice of *L. styraciflua* very different from that of liquid storax; and the fluid resin called liquidambar which I have met with has no resemblance to it. 2dly. Marquart³ analyzed a specimen of the genuine resin of *L. Altingia*, and obtained a volatile oil somewhat like styrol, and a substance similar to styracin; but their composition he found to be entirely different—for while styracin consists of $C^{24}H^{22}O^2$, the liquidambar resin was composed of $C^{16}H^{20}O^2$. 3dly. Landerer's account of *buchuri-jag* applies entirely to the liquid storax of the shops.

My friend, Mr. Daniel Hanbury, has recently received a specimen of *buchuri-jag* from Landerer. When mixed with water it has the opaque gray colour of liquid storax of commerce. It is devoid of the odour of Benzole or Naphthaline, but in other respects agrees with our liquid storax.

b. Pellucid Liquid Storax; Storax liquide pur, Guibourt. —This substance was sold to me under the name of *balsam* or *balsam storax*; and I was informed that it had been imported in jars, each holding 14 lbs. It agrees with the *pure* or *fine liquid storax* of Hill,⁴ and the *styrax liquida finissima* of Alston.⁵ Professor Guibourt, to whom I sent a sample, at first regarded it as balsam of liquidambar; but its odour has subsequently induced him to rank it among the products of *Styrax officinale*.⁶ It is a pellucid liquid, having the consistence and tenacity of Venice-turpentine, a brownish-yellow colour, a sweetish storax-like or vanilla-like odour,

¹ Phil. Trans. vol. xxvi. p. 44.

² Jahresbericht d. Pharmacie, p. 343, 1842.

³ Lectures on the Materia Medica, vol. ii. p. 418, 1770.

⁴ Hist. Nat. des Drogues, 4me edit. t. ii. p. 553, 1849.

⁵ United States Dispensatory.

⁶ History of the Materia Medica, p. 712, 1751.

entirely different from that of liquidambar. A few particles of bran or sawdust are intermixed with it. By keeping, it yields a white and acid sublimate on the sides of the bottle which contains it.

2. *Styrax calamita*;¹ *Styrax vulgaris*; *Common Storax*.—This probably is the inferior sort of storax described by both Dioscorides² and Pliny³ as being friable and branny, and which the latter writer states becomes covered with white mouldiness, “cano situ obductus.” This is imported in large round cakes, of a brown or reddish-brown colour and fragrant odour. It is brittle and friable, being very easily rubbed into a coarse kind of powder; yet it is soft and unctuous. When exposed to the air it becomes covered with an efflorescence (cinnamic acid?) which, to the superficial observer, looks like a whitish kind of mouldiness, and falls to powder. It appears to consist of some liquid resin mixed with fine sawdust or bran. Boiled with rectified spirit, it yields a reddish solution, which becomes milky on the addition of water. The insoluble residue is a reddish sawdust (of storax wood?). It seems probable, says Lewis,⁴ “that the common storax is the juice received immediately in vessels, and mixed with sawdust enough to thicken it; the shops requiring, under the name of storax, a solid or consistent mass, and evaporation being found to dissipate its fragrance. At least, I cannot conceive for what other purpose the woody matter could be added, for it is too easily distinguishable to have been intended as an imposition.”

The three following sorts are more or less allied to the *styrax calamita* of the shops, inasmuch as the body of them consists of sawdust. The term *scobs styracina* is applicable to all four sorts.

α. *Solid or Cake Storax* (*Storax solide* ou *Storax en pain*, Guibourt).—Under this name I have received from Professor Guibourt a substance very analogous to the preceding; but the sawdust obtained by digesting it in spirit is not so intensely red.

β. *Drop or Gum Storax*.—Under this name I have once met, in English commerce, a storax which was highly valued. It was a circular cake, about a foot in diameter, and four or five inches thick. It was blackish, with a greenish tint; had a pilular consistence, considerable tenacity, and a very agreeable odour. By keeping, it became covered with a crystalline efflorescence (of cinnamic acid?). Boiled in rectified spirit, it gave an inky appearance to the liquid, and left a blackish sawdust.

γ. *Hard blackish Storax*.—Under the name of *brown storax*, I purchased in Paris a solid, heavy, compact, hard, blackish substance, having the odour of liquid storax. Boiled in rectified spirit, it yielded an almost colourless liquid and a brownish sawdust. Is this the false storax which Guibourt⁵ says is made at Marseilles?

Besides the preceding sorts of storax (the only ones found in English commerce) there are several other kinds which deserve a brief notice.

3. *Storax in the Tear* (*Styrax in granis*).—Yellowish-white or reddish-yellow tears, about the size of peas. *White storax* (*styrax albus*) is formed of tears agglutinated so as to form masses somewhat resembling pale galbanum. Both sorts, however, are exceedingly rare, and are unknown to our drug-dealers. I have never met with a single specimen in English commerce. White storax is also scarce in Paris; for Professor Guibourt, to whom I wrote for a sample, says that there was one fine specimen at a druggist's in Paris, but it was not for sale. “I discovered it (says he) with great pleasure, having established the distinction of that variety only from a scrap of one or two drachms.”

This probably is the sort described by Dioscorides as being a transparent tear-like gum resembling myrrh, and which was very scarce.

4. *Amygdaloid Storax* (*Styrax amygdaloides*).—It occurs in compact masses, having a very agreeable odour, analogous to that of vanilla, and a yellowish or reddish-brown colour. They are interspersed with white tears (giving the mass an

¹ *Calamita*, from κάλαμος; a cane or reed. Galen (*De antidotis*, lib. i. cap. xiv.) speaks of a sort of storax brought from Pamphylia in reeds (ἐν τοῖς καλάμοις). Hoffman (*Lezicon universale*) derives the term *calamita* (or, as he writes it, *calamites*) from the circumstance that the wood of the storax-tree is devoured by an insect (Strabo, lib. xii.), and the stem thereby reduced to a hollow shell, like a reed—a very improbable explanation.

² Lib. i. cap. lxxix.

³ *Chem. Works of C. Neumann*, by W. Lewis, p. 290, 1759.

⁴ *Hist. Nat. des Drog.* 4ème edit. t. ii. p. 554, 1849.

⁵ *Hist. Nat.* lib. xii. cap. lv. ed. Valp.

amygdaloid appearance). This variety is very scarce. I had a fine sample, weighing nearly two ounces and a quarter; it cost me, in Paris, 24 francs per ounce. There is (or was a few years since) a magnificent piece in the possession of a French pharmacien, who offered to sell it for 500 francs. Amygdaloid and white storax were formerly imported enveloped in a monocotyledonous leaf, under the name of *cane* or *reed storax* (*storax calamita verus*). A fine specimen (about the size and shape of half an orange) is in Dr. Burgess's collection, belonging to the Royal College of Physicians of London.

Amygdaloid storax is described by Dioscorides as being the best sort. He says it is unctuous, yellow, resinous, mixed with whitish lumps, and forms a honey-like liquid when melted; it comes, he adds, from Gabala [a Phœnician city], Pisidia, and Cilicia [countries of Asia Minor].

5. **Reddish brown Storax** (*Storax rouge-brun*, Guibourt).—This differs from the preceding in the absence of the white tears, and in the presence of sawdust. It is reddish-brown, and has a similar but less powerful odour to that of the amygdaloid kind. It is not found in the London drug-houses.

The Pharmaceutical Society has a large cake of storax which is somewhat intermediate between this and the amygdaloid sort. Professor Guibourt, who examined it, considered it to be *falsified brown storax*. Micaceous films or crystalline plates are formed on its surface.

6. **Black Storax**.—Under the name of *Storax noir*, I have received from Professor Guibourt a very dark reddish-brown mass, which easily softens, and has the odour of vanilla. "It appears to be formed of a balsam, which has been melted and inspissated by heat with sawdust. Its very characteristic odour leads me to consider it," says M. Guibourt,¹ "as different from storax calamita, storax liquida, and liquidambar." It is not found in the London drug-houses.

Storax Bark is supposed to constitute the *cortex thymiamatis vel thuris* of some pharmacologists. It is probably the *ῥάσκαφθου* of Dioscorides.² It is in thin, light, red, highly odorous fragments or shavings, frequently covered with an efflorescence. I am indebted for a sample of it to Professor Guibourt.

COMMERCE.—I find, on the examination of the books of a wholesale druggist, that all the storax (solid and liquid) imported into this country during seven years came from Trieste.

COMPOSITION.—Neumann³ submitted *common storax* (*styrax calamita*, offic.) to a chemical examination. More recently, Reinsch⁴ analyzed three kinds of *styrax calamita*. In 1830, Bonastre⁵ analyzed a *storax from Bogota*. The same chemist⁶ examined a fluid, which he termed *liquid storax*, but which was *liquidambar* (see ante, p. 313).

Liquid storax has been analyzed by Simon;⁷ and some of its constituents have been examined by Drs. Blyth and Hoffman,⁸ by Toel,⁹ by Strecker,¹⁰ and by Scharling.¹¹

1. *Composition of Styrax calamita*.—The following are the results of Reinsch's analyses of this substance.

¹ Letter to the Author.

² Chem. Works, by Lewis, p. 290.

³ Journ. de Pharm. t. xvi. p. 88.

⁴ Ann. der Pharmacie, Bd. xxxi. 1839; Journ. de Pharmacie, t. xxvi. p. 241, 1840.

⁵ Memoirs of the Chemical Society, vol. ii. p. 334, 1845.

⁶ Ibid. vol. vii. p. 272, 1849.

⁷ Lib. i. cap. 22.

⁸ Pharm. Central-Blatt für 1838. S. 537 and 810.

⁹ Journ. de Pharm. t. xvii. p. 338.

¹⁰ Journ. de Pharm. t. xxvi. p. 241, 1840.

¹¹ Chemical Gazette, vol. vii. p. 249, 1849.

¹² Ibid. vol. vii. p. 419, 1849.

REINSCH'S ANALYSES OF STYRAX CALAMITA.

	1. <i>Storax calamita.</i> Opt. 1785. Nestler.	2. <i>Brown granular.</i>	3. <i>Reddish compact.</i>
Volatile oil	?	0.5	0.4
Resin	41.6	53.7	32.7
Subresin	?	0.6	0.5
Benzoic acid	2.4	1.1	2.6
Gum and extractive	14.0	9.3	7.9
Matter extracted by potash	15.0	9.6	23.9
Woody fibre	22.0	20.2	27.0
Ammonia	traces	stronger traces	strongest traces
Water	5.0	5.0	5.0
<i>Storax calamita.</i>	100.0	100.0	100.0

The volatile oil was obtained by digesting the distilled water of storax with ether. The solid oil was white, crystalline, and fusible; its odour was agreeable, its taste aromatic and warm. The fluid oil had not so penetrating an odour.

2. *Composition of Liquid Storax.*—Simon found liquid storax to consist of a volatile oil (called *styrole*), *cinnamic acid*, *styracine*, a soft resin, and a hard resin.

1. **VOLATILE OIL OF LIQUID STORAX; Styrole.** Formula $C^{16}H^8$.—Obtained by submitting liquid storax to distillation with an aqueous solution of carbonate of soda. It is a colourless, extremely volatile, transparent liquid, which has a burning taste and a peculiar aromatic odour, resembling a mixture of benzole and naphthaline. Exposed to the cold produced by a mixture of ether and carbonic acid, it freezes into a beautiful white crystalline mass. Its sp. gr. is 0.924 at the ordinary temperature of summer. It is soluble in alcohol and ether, burns with a sooty flame, boils at about 295° F., and at a somewhat higher temperature is converted into a firm transparent solid called *metastyrole* (Simon's *oxide of styrole*), which is isomeric with, and has the same refractive power as styrole.

2. **CINNAMIC ACID; Cinnamyllic Acid.** Formula $C^{18}H^{17}O^3 + HO$. Eq. 148. Symbol $\overline{C}i$, or CiO .—This acid is a constituent of the balsams of Tolu and Peru, and of the yellow resin of *Xanthorrhoea* (see *ante*, p. 215), as well as of liquid storax. It is also formed by the oxidation of the hydruret of cinnamyle or oil of cinnamon (see *ante*, p. 391). It is a colourless crystalline acid, having a feebly aromatic acid taste, and being sparingly soluble in cold water, but readily soluble in alcohol. It is deposited from its aqueous solution in water in the form of pearly plates, but from alcohol in rhombic prisms. It fuses at about 250° , and boils at 560° F. It has some resemblance to benzoic acid, for which it was formerly mistaken; but it may be distinguished by boiling it with a solution of chromic acid, when it gives rise to the production of oil of bitter almonds, of which benzoic acid does not yield a trace. Taken at bedtime in doses of from 80 to 90 grains, Erdmann and Marchand¹ found that, like benzoic acid (see vol. i. p. 212), it becomes converted in the human body into hippuric acid, which passes in the urine.

3. **STYRACINE.**—This is found in the still after the distillation of styrole from liquid storax. It is a crystallizable substance soluble in boiling alcohol and in ether, but insoluble in water. Its formula, according to Simon, is $C^{24}H^{11}O^2$. But Toel, who regards it as a combination of cinnamic acid having a perfectly analogous constitution to the natural fats, says its composition is best expressed by the formula $C^{80}A^{25}O^6$. By distillation with caustic potash it yields a crystallizable substance called *styrone*, whose composition is, according to Toel, $C^{42}H^{29}O^5$. Strecker regards styracine as a compound of cinnamic acid $C^{18}H^{17}O^4$, and of styrone, $C^{18}H^{10}O^2$, but minus $2HO$.

4. **RESINS OF LIQUID STORAX.**—These are two in number; one soft, the other hard.

PHYSIOLOGICAL EFFECTS.—Storax produces the before-described effects of the balsamic substances (see vol. i. p. 255). Its stimulant properties are more particularly directed to the mucous surfaces, especially to the bronchial membrane. Hence it is called a stimulating expectorant. In its operation it is closely allied to balsam of Peru and benzoin, but is less powerful than the latter. As it contains cinnamic acid, its use increases the quantity of hippuric acid in the urine.

USES.—Internally, storax has been principally employed in affections of the organs of respiration. In chronic bronchial affections, admitting of the use of stimulants, it may be used as an expectorant. It has also been employed in chronic

¹ *Chemical Gazette*, vol. i. p. 29, 1842.

catarrhal affections of the urino-genital membrane. Applied to foul ulcers in the form of ointment, it sometimes operates as a detergent, and improves the quality of the secreted matter.

ADMINISTRATION.—Purified storax may be exhibited in the form of pills, in doses of from grs. x to ʒj.

1. STYRAX PRÆPARATA, L.; Extractum Styracis, E.—(Dissolve 1 lb. of Storax in 4 pints of rectified spirit, and strain; then let the greater part distil with a gentle heat, and evaporate the residue in a water-bath until it becomes of a proper consistence, *L.*—The directions of the *Edinburgh College* are essentially the same, except that the evaporation is ordered to be carried on by the vapour-bath, until the product have the consistence of a thin extract.)—This process is intended for the purification of *styrax vulgaris* (*styrax calamita*, offic.); but Mr. Brande says it is inefficient. The *strained storax* of the shops (*styrax colatus*) is usually produced from liquid storax (see *ante*, p. 565). It is used in perfumery, and in the preparation of *tinctura benzoini composita*, and the *pilulæ styracis compositæ*.

2. PILULÆ STYRACIS COMPOSITÆ, L.; Pilulæ Styracis, E.; Pills of Storax.—(Strained Storax [Extract of Storax, *E.*] ʒvj; Opium [powdered, *L.*] ʒij; Saffron ʒij. Beat them together until incorporated [and divide the mass into 60 pills, *E.*].)—These pills are useful in chronic coughs, and some other pulmonary affections. They are valuable also in another point of view; they sometimes enable us to exhibit opium to persons prejudiced against its use; the saffron and storax concealing the smell and flavour of this narcotic, while the name of the pill cannot discover the harmless deception. The dose is from grs. v to grs. x.

204. STYRAX BENZOIN, *Dryand.*—THE BENJAMIN TREE.

Benzoin officinale, Hayne.

Sez. Syst. Decandria, Monogynia.

(Balsamum ex incisio cortice laxum, dore induratum; Acidum e Benzoino sublimatione comparatum, crystalli, *L.*—Concrete balsamic exudation, *E.*—The concrete exudation, *D.*)

HISTORY.—As the ancients were acquainted with so many oriental vegetable products, we should have expected, *à priori*, that benzoin would have been known to them. But this does not appear to have been the case; at least, we are unable to identify it with any of the substances described by the old writers.¹

BOTANY. Gen. Char.—Vide *Styrax officinale*.

Sp. Char.—Branchlets whitish-rusty-tomentose. Leaves oblong, acuminate, whitish tomentose beneath. Racemes compound, axillary, nearly the length of the leaves, and as well as the flowers horny-tomentose. Pedicels one-third as long as the flower. Calyx hemispherical sub-5-dentate (*Alph. De Cand.*).

Tree. *Stem* thickness of a man's body. *Leaves* oval-oblong, entire. *Calyx* campanulate, very obscurely five-toothed. *Corolla* gray, of 5 petals, perhaps connate at the base. *Stamens* 10. *Ovary* superior, ovate; *style* filiform; *stigma* simple. (Condensed from *Dryander*).²

Hab.—Sumatra, Borneo, Siam, Java.

EXTRACTION OF THE BALSAM.—Benzoin is obtained in Sumatra as follows: When the tree is six years old, longitudinal or somewhat oblique incisions are made in the bark of the stem, at the origin of the principal lower branches. A liquid exudes, which, by exposure to the sun and air, soon concretes, and the solid mass is then separated by means of a knife or chisel. Each tree yields about three pounds of benzoin annually, for the space of ten or twelve years. That which exudes during the first three years is white, and is denominated *head benzoin*. The benzoin which subsequently flows is of a brownish colour, and is termed *belly benzoin*. After the tree is cut down the stem is split, and some benzoin scraped

¹ See *Garcinus, Arom. Hist.* in *Clusius, Exot.* p. 155.

² *Phil. Trans.* vol. lxxvii. p. 308.

from the wood; but its colour is dark, and its quality bad, owing to the intermixture of parings of wood and other impurities: this sort is called *foot benzoin*. The relative values of head, belly, and foot benzoin, are as 105, 45, 18. Benzoin is brought down from the country in large cakes (called by the natives *tampangs*) covered with mats. In order to pack it in chests, these cakes are softened by heat; the finer by exposure to the sun, the coarser by means of boiling water.¹

DESCRIPTION.—The several sorts of benzoin (*benzoinum*; *asa dulcis*) met with in commerce may be conveniently arranged under two heads, viz. *Siam benzoin* and *Sumatra benzoin*.

1. **Siam Benzoin** (*Benzoinum Siamense*).—Crawford² says that the benzoin of Siam is procured from Lao. He also states that a substance resembling, and hitherto confounded with, benzoin, produced in Lao, Raheng, Chiang-mai, and La Kon, is abundantly found in Siam. The tree producing it cannot be, he thinks, the *Styrax Benzoin*, as it grows as far north as the twentieth degree of latitude.

Siam Benzoin is brought to England, either direct from Siam, or indirectly by way of Singapore. It includes the best commercial sorts, or those known in commerce as *benzoin of the finest quality*. It occurs in tears, in irregular lumps, and in cubical blocks; but unlike the Sumatra sort it never comes over enveloped in calico. It is in general distinguished from the other sorts by its warmer or richer (yellow, reddish, or brown) tints. The dealers distinguish five or six qualities, the three best sorts being included under the name of *yellow Siam benzoin*, and the two or three inferior kinds being called *red or brown Siam benzoin*; the designations yellow, red, or brown, being used on account of the tint of this resin by which the tears are agglutinated. But the division is altogether arbitrary, the colours passing universally into one another. I shall, therefore, adopt another arrangement.

a. *Siam benzoin in tears* (*Benzoinum Siamense in lacrymis*); *Yellow benzoin in the tear*.—This kind seems to be identical with the *true benzoin in tears*, which Savary³ says was brought in considerable quantity to Paris, by the attendants of the Siamese ambassadors. It consists of irregular flattened pieces, some of which are angular, and the largest of them barely exceeding an inch in length. Externally, these pieces are shiny, or dusty from their mutual friction, and are of an amber or reddish-yellow colour; they are brittle, and may be easily rubbed to powder. Internally, they are translucent or milky, and frequently striped; they have a pleasant odour, but little or no taste. There is an inferior sort of Siam benzoin in tears, which consists of loose drops mixed with pieces of wood and other impurities. It is worth only one-fourth of the price of clean good-sized tears or clean lump.

β. *Siam or lump benzoin* (*Benzoinum Siamense in massis*).—The finest kind consists of agglutinated tears (*white or yellow lump benzoin*). More commonly, we find the tears are connected together by a brown resiniform mass, which, when broken, presents an amygdaloid appearance, from the white tears imbedded in the mass (*amygdaloid benzoin*; *benzoinum amygdaloides*).

Inferior sorts of lump benzoin are reddish (*red lump benzoin*).

γ. *Translucent Benzoin*.—From my friend, Dr. Royle, I have received a sample of Siam benzoin, whose properties are somewhat different from the preceding. The small masses consist of agglomerated tears, which, instead of being white and opaque, are translucent, or, in a few instances, almost transparent.

2. **Sumatra Benzoin**. (*Benzoinum ex Sumatrâ*). Though placed here second, this sort is the more important, being in many countries the only kind known. It is rarely imported directly from Sumatra, but in general indirectly by way of Singapore or Bombay, and now and then from Calcutta. Hence, it is sometimes called *Calcutta benzoin*, though this port is out of the usual course.

¹ Marsden, *History of Sumatra*, 3d edit. p. 134; Crawford, *Hist. of the Ind. Archipel.* vol. i. p. 517; and vol. iii. p. 418.

² *Journal of an Embassy to Siam and Cochinchina*, p. 407, 1829.

³ Alston, *Lect. on the Mat. Med.* vol. ii. p. 403.

It occurs in large rectangular blocks, marked with the impression of a mat, and covered with white cotton cloth. When broken, we observe but few large white tears in it. The mass is principally made up of a brown resiniform matter, with numerous, white, small pieces or chips intermixed, which thereby give the broken surface a speckled appearance, somewhat like that of a fine-grained granite.

The qualities of Sumatra benzoin are distinguished as *first*, *seconds*, and *thirds*.

a. The *first Sumatra sort* occurs very seldom, and only by single chests, for which £50 or more the *cwt.* are paid for the Russian market.

β. The *second Sumatra sort* is also marbly, but not so white; and is also mostly taken for the Russian market at £20 to £30 the *cwt.* Thirty chests of this sort perhaps are seen before one of the first quality is met with.

γ. The *third Sumatra sort* is browner, and less, or not at all marbly. It fetches from £9 to £15 per *cwt.* and forms the usual commercial quality (*common or brown benzoin*; *benzoinum commune vel in sortis*). Five times as much of this quality is met with as of all the other sorts put together.

There is a very inferior sort of benzoin (*inferior Bombay benzoin*), which invariably comes by way of Bombay. If it be the produce of Sumatra, it is remarkable that it never comes by way of Singapore.

COMMERCE.—Benzoin is sometimes imported into England direct from Siam and Sumatra; but usually indirectly from Singapore, Bombay, Penang, Calcutta, Madras, Batavia, &c. The greater part is re-exported for use in the ceremonies of the Greek and Catholic churches. In 1839, only 108 cwts. paid duty.

COMPOSITION.—Benzoin has been the repeated subject of chemical analysis. It was analyzed in 1811 by Bucholz,¹ in 1816 by John,² in 1823 by Stoltze,³ and in 1845 by Kopp.⁴ It has also been the subject of chemical examination by Brande,⁵ Unverdorben,⁶ and others.

	Bucholz.	John.	Stoltze.		
			White.	Amygdaloid.	Brown.
Volatile oil (aroma, John)	—	—	traces.	traces.	traces.
Benzoic acid	12.5	12.0	19.80	19.42	19.70
Resin { yellow, soluble in ether } { brown, insoluble in ether }	83.3	84.5	{ 79.83 0.25	{ 27.10 50.53	{ 8.80 69.73
Matter like balsam of Peru	1.7	—	—	—	—
Aromatic extractive	0.5	0.50	—	0.25	0.15
Woody matter and other impurities	2.0	2.00	—	2.60	1.45
Water and loss	—	0.25	0.12	0.10	0.17
Salts (benzoates and phosphates)	—	0.75	—	—	—
Benzoin	100.0	100.00	100.00	100.00	100.00

Kopp followed Unverdorben's method of analysis, and obtained in two different specimens the following results:—

	I.	II.
Benzoic acid	14.0	14.5
Resin (α) soluble in ether	52.0	48.0
Resin (β) soluble in alcohol only	25.0	28.0
Resin (γ) soluble in a solution of carbonate of soda	3.0	3.5
Brown resin deposited by ether	0.8	0.5
Impurities	5.2	5.5
	100.0	100.0

Wackenroder⁷ obtained 9 per cent. of benzoic acid from Siam benzoin.

¹ Trommsdorff's *Journ. de Pharm.* Bd. xx. quoted by Stoltze.

² *Naturgesch. d. Succins*, Köln, 1816, quoted by Stoltze.

³ *Deutsches (Berlin) Jahrbuch für die Pharmacie*, Bd. x. pp. 55 and 77, 1823.

⁴ *Journ. de Pharm.* 3me ser. t. vii. p. 46, 1845.

⁵ Poggendorff's *Annalen*, xvii. 179.

⁶ *Nicholson's Journal*, x. 82.

⁷ *Pharm. Central-Blatt für* 1843, p. 336.

1. **VOLATILE OIL OF BENZOIN.**—Distilled with water, benzoin does not yield any essential oil; but when exposed to heat without water, benzoic acid and an essential oil are volatilized. This oil may be deprived of its empyreuma by redistillation with water, and then smells agreeably of benzoin. It may be regarded as a product of the decomposition of the resin. An oil of benzoin obtained by distillation, without any liquid, is used at Sumatra as a perfume.¹

2. **RESINS OF BENZOIN.**—By digesting benzoin in alcohol, a tincture is obtained, which on the addition of water, forms a milky fluid (formerly absurdly called *virgin's milk*). The resin thus precipitated was formerly called the *magisterium benzoës*. The acids (acetic, hydrochloric, and sulphuric) also occasion a precipitate in the alcoholic solution. Sulphuric acid yields a fine red colour with the resin of benzoin; chloride of iron a green.

α resin: *Alpha-resin of benzoin.*—Composed of the resins β and γ . $C^{40}H^{23}O^7 + C^{24}H^{12}O^5 = C^{64}H^{35}O^{12}$ (Van der Vliet² and Mulder³).—Soluble in ether, but insoluble in carbonate of potash.

β resin; *Beta-resin of benzoin.* $C^{40}H^{23}O^9$.—Soluble in alcohol, but insoluble in ether and in carbonate of potash.

γ resin; *Gamma resin of benzoin.* $C^{30}H^{20}O^5$.—Soluble in carbonate of potash, and slightly so in ether.

3. **BENZOIC ACID.**—See p. 573.

We may assume, observe Pelouze and Fremy,⁴ that benzoin, at the instant of its secretion, contains two different liquids: one, which produces the resin; the other, which, by becoming oxidized, is transformed into benzoic acid.

PHYSIOLOGICAL EFFECTS.—Benzoin produces the general effects of the balsams before mentioned (see vol. i. p. 255). Its power of producing local irritation renders it apt to disorder the stomach, especially in very susceptible individuals. Its constitutional effects are those of a heating and stimulating substance, whose influence is principally directed to the mucous surfaces, especially of the air-tube. It is more acrid and stimulant, and less tonic, than myrrh, to which some pharmacologists have compared it. It has appeared in some instances to act as a stimulant to the sexual organs. As it contains benzoic acid it must increase the proportion of hippuric acid in the urine (see vol. i. p. 212; and also p. 574).

USES.—As an internal remedy the employment of benzoin is almost wholly confined to chronic pulmonary affections, especially those of the bronchial membrane. Its stimulant properties render it improper in all acute inflammatory complaints, and its acridity prevents its employment where there is much gastric irritation. Its use, therefore, is better adapted for torpid constitutions. Trousseau and Pidoux⁵ speak most favourably of the effects of the balsams in chronic laryngitis, as I have before noticed (see vol. i. p. 265). The mode of employing benzoin in balsamic fumigations in this disease has been already noticed (see vol. i. p. 255).

ADMINISTRATION.—Benzoin is scarcely ever administered alone.—The dose of it in powder is from grs. x to ʒss.—On account of the agreeable odour evolved when benzoin is heated, this balsam is frequently employed for fumigations, as in the ceremonies of the Greek and Roman Catholic churches.

1. **TINCTURA BENZOINI COMPOSITA**, L. E. [U. S.]; *Balsamum Traumaticum*; *Compound Tincture of Benjamin*; *Wound Balsam*; *Balsam for Cuts*; *Friar's Balsam*; *Jesuit's drops*; *The Commander's Balsam*.—(Benzoin, in coarse powder, ʒiijss [ʒiv, E.]; [Storax, prepared, ʒijss, L.]; Balsam of Tolu ʒx [Peru-balsam ʒijss, E.]; Socotrine or Hepatic Aloes ʒv [East Indian Aloes ʒss, E.]; Rectified Spirit Oij. Macerate for seven days [pour off the clear liquor, E.], and strain. [The U. S. Pharm. directs, Benzoin ʒiij; Purified Storax ʒij; Balsam of Tolu ʒj; Aloes, in powder, ʒss; Alcohol Oij. Macerate for fourteen days, and filter.]—A stimulating expectorant; administered in chronic catarrhs.)—Dose, fʒss to fʒij. It is decomposed by water. A very pleasant mode of exhibiting it is in the form of emulsion, prepared with mucilage and sugar, or yolk of egg. Tincture Benzoini composita is occasionally applied to foul and indolent ulcers, to excite the vas-

¹ Marsden, *Sumatra*, p. 184.

² *Journ. f. pr. Chem.* xviii.; *Pharm. Central-Blatt für 1839*, p. 875.

³ *The Chemistry of Vegetable and Animal Physiology*, p. 819, 1849.

⁴ *Cours de Chimie Générale*, t. iii. p. 556, 1850.

⁵ *Traité de Thérap.* ii. p. 477.

cular action and to improve the quality of the secreted matter. It is a frequent application to recent incised wounds. If applied to cut surfaces it causes temporary pain, and cannot promote adhesion (or union by the first intention), though by exciting too much inflammation it may sometimes prevent it. But when the edges of the wound have been brought together, the tincture may be carefully applied to the lint or adhesive plaster as a varnish or cement. Here it acts mechanically, excluding air, and keeping the parts in their proper position. In the same way, it may sometimes prove serviceable in contused wounds. *Court or Black Sticking Plaster* (*Emplastrum adhaesivum Anglicum*, Ph. Bor.) is prepared by brushing first a solution of isinglass, and afterwards a spirituous solution of benzoin, over black sarcenet.

2. PASTILLI FUMANTES, *Fumigating or Aromatic Pastiles*.—(Benzoin, in powder, sixteen parts; Balsam of Tolu; Sandal-wood, in powder, of each four parts; True Labdanum, one part; a light [linden] charcoal, forty-eight parts; Nitrate of Potash, two parts; tragacanth, one part; Gum Arabic, two parts; Cinnamon Water, twelve parts. F. S. A. a soft and ductile mass, which is to be formed into cones, with a flat tripod base. Dry at first in the air, afterwards by a stove.)¹—By burning, these pastiles diffuse a very agreeable odour. They are employed to disguise or over power unpleasant smells (see vol. i. p. 205).

The *Species ad suffiendum*, Ph. Bor., consists of benzoin and amber, of each ℥ss, and lavender flowers, ʒij.

3. ACIDUM BENZOICUM, L. E. D. [U. S.]; *Benzoic Acid; Flowers of Benjamin* (*Flores Benzoini*). Symbol Bz or BzO. Formula $C^{14}H^5O^3$. Equivalent 113.—The crystallized acid contains 1 equivalent of water; Bz.HO=122.

This acid was described in 1608 by Blaise de Vigenere; but it seems to have been known to Alexander Pedemontanus in 1560. It is formed by the oxidization of the volatile oil of bitter almonds (hydruret of benzule); $C^{14}H^6O^2 + O^2 = C^{14}H^5O^3.HO$. Chloride of benzule by the action of potash is converted into the benzoate of potash; $C^{14}H^5O^2.Cl + 2KO = KO, C^{14}H^5O^3 + KCl$. Hippuric acid under the influence of acids is converted into benzoic acid and gelatin sugar: $C^{15}H^9NO^6 + 2HO = C^{14}H^5O^3.HO + C^4H^5NO^4$.

But the usual method of obtaining benzoic acid for medicinal use is from benzoin, by either sublimation or the action of alkalies—commonly by sublimation. Mohr's process² is that adopted in the *Dublin Pharmacopœia* (1850).

"Take of Benzoin any convenient quantity; place it in a small cylindric pot of sheet-iron furnished with a flange at its mouth; and, having fitted the pot into a circular hole in a sheet of pasteboard, interpose between the pasteboard and flange a collar of tow, so as to produce a nearly air tight junction. Let a cylinder of stiff paper, open at one end, eighteen inches high, and having a diameter at least twice that of the pot, be now placed in an inverted position on the pasteboard, and secured to it by slips of paper and flour paste; a couple of inches of the lower part of the pot being passed through a hole in a plate of sheet tin, which is to be kept from contact with the pasteboard by the interposition of a few corks, let a heat just sufficient to melt the benzoin (that of a gas-lamp answers well) be applied, and continued for at least six hours. Let the product thus obtained, if not quite white, be enveloped in bibulous paper, then subjected to powerful pressure, and again sublimed."

Benzoic acid, on the large scale, is usually prepared by heating benzoin in a shallow iron pot, communicating with a box (or *house*, as it is frequently termed), made of pasteboard and laths, or of thin wood, and lined with loose sheets of blotting paper. A piece of fine muslin or paper is interposed between the mouth of the subliming pot and the box, to prevent the sublimate falling back into the pot. The vapours of the acid traverse the muslin or pores of the paper, and condense in the box.³

As met with in the shops, benzoic acid occurs in the form of soft, light, feathery

¹ Henry and Guibourt. *Pharm. Raison*. t. i. p. 402.

² Mohr and Redwood's *Practical Pharmacy*, p. 194, 1849.

³ For some practical remarks on the preparation of this acid, see Euler and Herberger, in *Pharmaceutisches Central-Blatt für 1840*, p. 166.

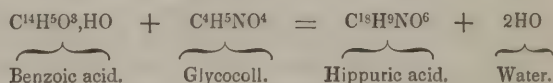
white crystals, or scales, which are flexible, transparent, and of a mother-of-pearl lustre, having a sour, warm taste, but no odour when pure. It readily fuses and volatilizes, its vapour being exceedingly irritating to the air-passages. It is combustible, burning with a bright yellow flame. It is very soluble in about two hundred parts of cold water, dissolves in about twenty-five parts of boiling water, and is very soluble in alcohol.

Benzoic acid is readily distinguished from other acids by its light and feathery crystals, its fusibility, volatility, odour of its vapour, by its great solubility in alkalis, by its property of being precipitated by acids from its alkaline solutions, and by the character of its soluble salts. Thus, the benzoate of ammonia produces, with the sesquisalts of iron, a pale-red precipitate ($\text{Fe}^2\text{O}^3, 3\text{Bz}$), and with the nitrate of silver and acetate of lead, precipitates (MO, Bz). From cinnamic acid (with which it has been confounded) it is distinguished by not yielding oil of bitter almonds when distilled with oxidizing agents, as chromic acid or a mixture of bichromate of potash and sulphuric acid (see *ante*, p. 568).

Good benzoic acid has the following properties: It is white or almost white. When cautiously heated it totally evaporates with a peculiar odour. It is sparingly soluble in water, but plentifully in rectified spirit. It is entirely dissolved by solutions of ammonia, potash, or soda, and in lime-water, and is precipitated from its solution by hydrochloric acid.—*Ph. Lond.* Colourless; sublimed entirely by heat.—*Ph. Ed.*

The local action of benzoic acid is that of an acrid. When swallowed it occasions a sensation of heat and acidity in the back part of the mouth and throat, and heat at the stomach. The inhalation of its vapour causes violent coughing.

On the general system it acts as a stimulant, whose influence is, however, principally directed to the mucous surfaces, especially the aerian membrane. In its passage through the system it abstracts the elements of glycocholl or gelatin sugar, and becomes converted into hippuric acid, which is thrown out of the system in the urine in combination with a base.



Mr. Alexander Ure¹ first pointed out the fact, that the quantity of hippuric acid in the urine is increased by the use of benzoic acid.² If, an hour after a meal, a scruple or half a drachm of benzoic acid be taken into the stomach, the urine subsequently voided, within three or four hours, will be found, on adding a small quantity (about one-twelfth part) of muriatic acid, to yield a copious precipitate of rose-pink acicular crystals of hippuric acid, which weigh, after being allowed to settle for a day, from fifteen to twenty-nine grains. Mr. Ure's observations were confirmed by the experiments of Dr. Garrod³ and Keller.⁴ It was also found by Keller, that the urine which yielded hippuric acid contained the normal proportion of both uric acid and urea.

USES.—Benzoic acid is a constituent of the *Tinctura Camphoræ Composita* [*Tr. Opii Camphorata*, U. S.]; but otherwise is but little employed in medicine. It is sometimes administered in chronic bronchial affections. I have repeatedly tried it, but have seldom seen benefit result from its use. I have more frequently seen it augment than relieve the cough. On account of the alteration which it effects in the quality of the urine, benzoic acid has been administered with the view of promoting the excretion of nitrogenous matter, the retention of which is the supposed cause of disease. Thus, Mr. Ure employed it in the gouty diathesis to prevent the formation of the tophaceous concretions commonly called *chalk stones*, and to cor-

¹ *Medico-Chirurgical Transactions*, vol. xxiv. p. 30, 1841; and *Pharmaceutical Transactions*, vol. i. p. 24, 1841.

² In 1831, Wöhler expressed his opinion that, by digestion, benzoic acid was probably converted into hippuric acid (Keller, *infra cit.*).

³ *Memoirs of the Chemical Society*, vol. i. p. 19, 1842.

⁴ Keller, *Ann. der Chem. u. Pharm.* Bd. xliii. p. 108, 1842.

rect and remove certain disordered states of the urine in individuals prone to attacks of gravel. But if Keller's observations (before stated) be correct, benzoic acid does not affect the quantity of uric acid in the urine. Farther experiments with it on a larger scale are desirable in order to determine positively whether it has or has not any influence over the excretion of uric acid or urea.—Dose, grs. v to 3j. It may be given in the form of a *benzoate* (which has a similar action on the urine to that of the free acid). For this purpose it may be dissolved in water by the aid of a few drops of a solution of either ammonia or potash.

ORDER L. SAPOTACEÆ, *Endlicher*.

CHARACTERS.—*Calyx* regular, persistent, in 5 or occasionally in 4—8 divisions, which are either valvate or imbricate in æstivation. *Corolla* monopetalous, hypogynous, regular, deciduous, its segments usually equal in number to those of the calyx, seldom twice or thrice as many, imbricate in æstivation. *Stamens* arising from the corolla, in number definite, distinct, the fertile ones equal in number to the segments of the calyx, and opposite those segments of the corolla which alternate with the latter, seldom more; *anthers* usually turned outwards. The sterile stamens as numerous as the fertile ones, with which they alternate. *Disk* 0. *Ovary* superior, with several cells, in each of which is 1 ascending or pendulous anatropal ovule; *style* 1; *stigma* undivided, occasionally lobed. *Fruit* fleshy, with several 1-seeded cells, or by abortion only 1; *Seeds* nut-like, sometimes cohering into a several-celled putamen; *testa* bony, shining, with a very long scar on the inner face, where it is opaque and softer than the rest; *embryo* erect, large white, usually inclosed in fleshy albumen; *Cotyledons*, when albumen is present, foliaceous; when absent, fleshy and sometimes connate; *radicle* short, straight, or a little curved, turned towards the hilum.—*Trees* or *shrubs*, chiefly natives of the tropics, and often abounding in milky juice. *Leaves* alternate, or occasionally almost whorled, without stipules, entire, coriaceous. *Inflorescence* axillary. *Flowers* hermaphrodite (Lindley).

PROPERTIES.—The fruit of many is esteemed as an article of dessert. The seeds of several yield a fatty oil. The bark of some species is bitter and astringent, and is used as a febrifuge.

205. *Isonandra Gutta*, *Hooker*.—The Gutta Percha Tree.

(Succus.)

Isonandra Gutta, Hooker, Lond. Journ. of Botany, 1848; and Pharmaceutical Journal, vol. vii. p. 179, 1848.—A tall tree, a native of the Malayan Archipelago, especially of Singapore. Its milky juice becomes concrete by exposure to the air, and forms the substance called *gutta percha*. "A magnificent tree of 50, or more probably 100 years growth, is cut down, the bark stripped off, and the milky juice collected and poured into a trough formed by the hollow stem of the plantain leaf; it quickly coagulates on exposure to the air; but from one tree I was told that not more than 20 lbs. or 30 lbs. are procured," (Montgomerie.)¹ It is extensively imported in blocks, and is purified by "devilling" or kneading in hot water. As imported, it is a white or dirty pinkish opaque solid. Its density is 0.79. Water, alcohol, alkaline solutions, muriatic and acetic acids, have no action on it. Oil of vitriol slowly chars it; nitric acid converts it into a yellow resin. Ether and coal naphtha soften it in the cold, and by the aid of heat effect an imperfect solution of it. Its best solvent is oil of turpentine. Its most important quality, and which renders it so useful in the arts, is the facility with which it softens and becomes plastic in hot water. In this state it may be readily moulded into any required shape, and joined, by pressure, to other pieces which have also been rendered plastic by heat. When it cools it resumes its original hard and tough nature.²—Gutta percha of commerce consists chiefly of a *peculiar substance* (gutta percha, properly so called) mixed with a small quantity of a *vegetable acid*, *casein* (hence, the cheesy odour which it sometimes possesses), a *resin* soluble in ether and in oil of turpentine, and a *resin* soluble in alcohol.³—The pure gutta percha is a carbo-hydrogen, analogous to caoutchouc.⁴—The uses of gutta percha in the arts are most extensive.⁵ It is already the subject of numerous patents.⁶ It also serves some useful purposes in medicine, surgery, and pharmacy. A solution of it in chloroform has been used by Prof. Simpson⁷ as a dressing of wounds. When a thin layer of the solution is spread upon the skin or any other surface, the chloroform rapidly evaporates, and leaves a film or web of gutta percha possessing all the tena-

¹ *Pharmaceutical Journal*, vol. vi. p. 377, 1847.

² See Solly, *Pharmaceutical Journal*, vol. v. p. 510, 1846.

³ Soubeiran, *Journ. de Pharm. et de Chimie*, 3me sér. t. xi. p. 17, 1847.

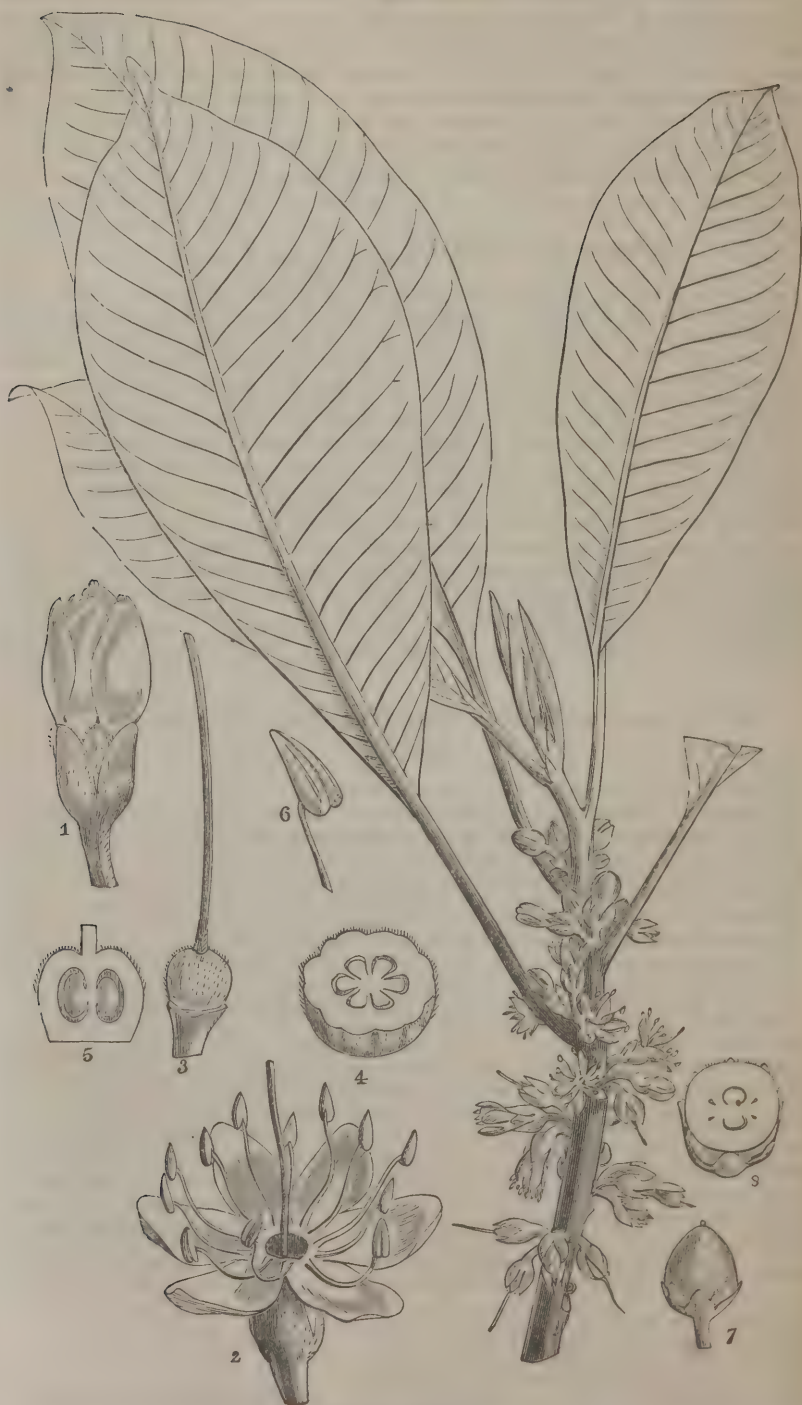
⁴ MacLagan, *Pharmaceutical Journal*, vol. v. p. 472, 1846.

⁵ *Ibid.* vol. vi. p. 382, 1847.

⁶ *Ibid.* vol. viii. p. 84, 1848.

⁷ *Ibid.* vol. viii. p. 141, 1849.

Fig. 319.

*Isonandra Gutta*, Hooker.

1. Flower scarcely expanded; 2, flower with the corolla expanded; 3, pistil; 4, transverse section of the ovary; 5, vertical section of the ovary; 6, anther; 7, scarcely mature fruit (natural size); 8, transverse section of ditto. (All but Fig. 7 magnified.)

city and other properties of that substance. A layer of it of the thickness of good writing-paper has perhaps as much strength and tenacity as to hold the edges of a wound together with all the required strength and firmness of sutures. Mr. Acton¹ finds that a compound solution of caoutchouc and gutta percha may be used to form a kind of membrane to protect the skin against the action of contagious poisons. The solution is prepared by adding a drachm of gutta percha to an ounce of benzole (the volatile principle of coal naphtha) and ten grains of India rubber to the same quantity of benzole, each being dissolved at a gentle heat, and then mixed in equal proportions. It may be used to protect the hands in *post-mortem* examinations, to prevent excoriation of the cheek in gonorrhœal ophthalmia, in covering parts contiguous to a sore where the water-dressing is used, &c. In the treatment of clubfoot, fractures, &c. Mr. Lyon² has found it a useful mechanical agent.

206. *Chrysophyllum Buranheim*, Riedel.

Sex. Syst. Pentandria, Monogynia.
(Cortex.)

Buranhem, *Guaranhem*, Tupin. (*Mohica* ?); Martius, *Syst. Mat. Med. Veg. Brasil.* p. 48, 1843: *Chrysophyllum glycyphlæum*, Casaretti, *Journ. de Pharm. et Chim.* t. vi. p. 64, 1844.—A tree growing in the Brazils near Rio de Janeiro. Its bark, which has long been in use among the Brazilians, was introduced into medicinal use, a few years ago,³ in France, under the name of *monesia* or *monesia bark* (*cortex monesia*). The recent bark is lactescent; but the bark, such as it comes to Europe, is thick, compact, heavy, very flat, brown, and hard, without any suberous or herbaceous layer. Its taste is at first sweet, afterwards astringent and bitter. It has been analyzed by B. Derosne, Henry, and Payen,⁴ who found it to consist of an *aromatic principle* (traces), *fat*, *chlorophylle*, and *wax*, 1.2; *glycyrrhizine*, 1.4; *monesine*, an acrid principle analogous to saponine, 4.7; *tannic acid* 7.5; *red colouring matter* analogous to that of cinchona and catechu (rubinic acid), 9.2; *gum* (small quantity), *supermalate of lime*, 1.3; *salts of potash, lime, and magnesia*, *silica*, *oxide of iron*, &c. 3.0; *pectine and lignine* 71.7=100. A blackish extract of the bark has been brought to Europe under the name of *extract of buranhem* or *guaranhem*; it strikes a blue colour with the salts of iron.—*Monesia* or *Buranhem* is an astringent. It is employed by the Brazilians in leucorrhœa, atonic diarrhœa, uterine hemorrhage, and chronic mucous discharges generally. It has been used in France and Germany in the same cases. But it does not appear to possess any superiority over rhatany, catechu, and other well-known astringents; and consequently it has now fallen into disuse. The aqueous extract is given in doses of from a scruple to a drachm. It is soluble both in water and spirit. An ointment containing a drachm of the extract to an ounce of fatty matter has also been employed as a topical astringent. *Monesine* has also been used in medicine.⁵

SUBDIVISION III. CALYCIFLORÆ, *De Cand.*

Calyx gamosepalous, i. e. *sepals more or less united at the base. Torus more or less adnate to the inside of the calyx at the base. Petals and stamens inserted into that part of the torus adnate to the calyx, and, therefore, commonly said to arise from the calyx. Petals free or united. Ovary free or adnate to the calyx.*

ORDER LI. PYROLACEÆ, *Lind.*—WINTER-GREENS.

CHARACTERS.—*Calyx* free, 4-, more frequently 5-partite, persistent. *Petals* 5, free or cohering, perigynous? with an imbricated æstivation. *Stamens* twice the number of the petals, to which they are not adherent; *anthers* bilocular, dehiscing by 2 pores. *Ovarium* 3- to 5-celled, seated on a hypogynous disk. *Style* 1. *Stigma* roundish or lobed, sometimes slightly indusiate. *Cap-sule* 3- to 5-celled, 3- to 5-valved, loculicidal dehiscent. *Placentæ* adherent at the centre. *Seeds* indefinite, minute, with a pellicle indusiate or winged. *Embryo* minute, at the base of fleshy albumen, with moderately distinct cotyledons. *Herbs*, natives of the northern hemisphere, perennial or scarcely under-shrubs, smooth. *Stems* round, naked, or leafy. *Leaves* simple, entire or dentate. *Flowers* racemose, somewhat umbellated, rarely solitary, white or rose-coloured. (*De Cand.*)

PROPERTIES.—In structure, proximate principles, and medicinal properties, this order is allied to Ericaceæ. Its prevailing principles are bitter, resinous, and astringent substances.

¹ *Ibid.* vol. viii. p. 297, 1849.

² *Half-yearly Abstract of the Medical Sciences*, vol. viii. p. 150.

³ *Journ. de Chim. Méd.* t. v. 2de sér. p. 333, 1839; Guibourt, *Journ. de Pharm.* t. xxv. p. 710, 1839.

⁴ *Journ. de Pharm.* t. xxvii. p. 20, 1841.

⁵ For further details respecting monesia, the reader is referred to Dierbach's *Neuest. Entd. in der Mat. Méd.* Bd. ii. p. 207, 1843; Dunglison, *New Remedies*, p. 438, 1816; and Merat, *Suppl. un Dict. Univ. de Mat. Méd.* p. 175, 1846.

207. CHIMAPHILA UMBELLATA, Nuttall.—PIPSISSEWA; UMBELLATED WINTER-GREEN.

Chimaphila corymbosa, Pursh — *Pyrola umbellata*, Linn.

Sez. Syst. Decandria, Monogynia.

(Herba, L.—Herb, E. D.)

HISTORY.—The Pipsissewa was employed medicinally by the aborigines of America. It was first described and figured by Clusius,¹ who termed it *Pyrola 3 vel frutescens*; and it was introduced to the notice of the profession, in 1803, by Dr. Mitchell.² Monographs on it have been published by Elias Wolf,³ and by Radius.⁴ Its generic name is derived from *χειμα*, winter, and *φίλος*, a friend.

BOTANY. **Gen. Char.**—*Calyc* 5-cleft. *Petals* 5, spreading, deciduous. *Stamens* 10, 2 in front of each petal; *filaments* dilated in the middle. *Ovarium* rounded-obconical, obtusely angular, umbilicated at the apex. *Style* very short, concealed in the umbilicus of the ovary. *Stigma* orbicular, tuberculated, 5-crenate. Cells of the *capsule* dehiscent at the apex; the valves not connected by tomentum. (*De Cand.*)

Sp. Char.—*Filaments* smooth. *Bracts* linear-awl-shaped. *Leaves* cuneate-lanceolate, of the same colour. (*De Cand.*)

A perennial under-shrub. *Rhizome* woody, creeping. *Stems* ascending, somewhat angular, marked with the scars of former leaves. *Leaves* in irregular whorls, evergreen, coriaceous, on short petioles, serrate, smooth, shining. *Flowers* nodding in a small corymb. *Corolla* white, tinged with red, having an agreeable odour.

Hab.—Woods of Europe, Asia, and more frequently North America.

DESCRIPTION.—The officinal parts are the leaves (*folia chimaphilæ seu pyrolæ*), or rather the leaves and the stems (*herba chimaphilæ seu pyrolæ*). The fresh leaves exhale a peculiar odour when bruised; their taste is bitter and astringent. The infusion of the dried herb is rendered green (tannate of iron) by sesquichloride of iron, and very slightly turbid by a solution of isinglass.

Chimaphila maculata, or spotted winter-green, probably possesses similar virtues to the *C. umbellata*. "The character of the leaves of the two plants will serve to distinguish them. Those of *C. maculata* are lanceolate, rounded at the base, where they are broader than near the summit, and of a deep olive green colour, veined with greenish white; those of the officinal species are broadest near the summit, gradually narrowing to the base, and of a uniform shining green. In drying, with exposure to light, the colour fades very much, though it still retains a greenish hue," (*Wood*).⁵

COMPOSITION.—This plant has been analyzed by Elias Wolf and by Fr. Martens;⁶ their results are as follows:—

Wolf's Analysis.		Martens's Analysis.	
Bitter extractive	18.00	Bitter gummy extractive, with a small quantity of tannin and some vegetable calcareous salts	16.66
Resin	2.40	Oxidized extractive	1.25
Tannin	1.38	Soft resin and chlorophylle	3.00
Woody fibre, with a small proportion of gum and vegetable calcareous salts	78.22	Balsamic hard resin	5.77
		Tannin with gallic acid	3.77
		Woody fibre	63.00
		Moisture and loss	7.50
	100.00		100.00

The activity of the plant resides, in part at least, in the bitter extractive, resin, and tannin; but it is probable that there is also some volatile constituent (essential oil?) in the fresh plant to which the medicinal properties of the plant are in part due.

PHYSIOLOGICAL EFFECTS.—The fresh leaves appear to possess considerable acridity, depending, probably, on some volatile constituent; for Dr. Barton says,

¹ *Historia Pannonica*.

² *Diss. de Pyrola umbell.* Goett. 1817.

³ *Dissert. de Pyrola et Chimaph.* Spec. i. 1821; Spec. ii. 1829.

⁴ *Martiny, Encyklop. de med. pharm. Natural u. Rokrwaarenkunde*, Bd. i. p. 753, 1843.

⁵ *Inaug. Diss.* Philad. 1803.

⁶ *United States Dispensatory*.

that, when bruised, they produce rubefaction, vesication, and desquamation, if applied to the skin.

The infusion of the dried leaves, when swallowed, acts as a tonic, producing an agreeable sensation in the stomach, and assisting the appetite and digestive process. It promotes the action of the secreting organs, more especially the kidneys, over which, indeed, it has appeared to exercise a specific influence; increasing the quantity of urine; diminishing, as some have imagined, the quantity of lithic acid or lithates secreted; and beneficially influencing several forms of chronic nephritic disease. Indeed, this plant possesses, in its medicinal as well as its natural-historical and chemical relations, qualities analogous to those belonging to *Uva-ursi*.

USES.—The following are the principal diseases in which it has been employed:—

1. *In dropsies*, accompanied with great debility and loss of appetite, it is useful as a diuretic, as well as on account of its stomachic and tonic qualities. It was introduced to the notice of practitioners in this country as a remedy for this class of diseases, by Dr. W. Somerville.¹ Dr. Beatty² has also found it useful in this disease.

2. *In chronic affections of the urinary organs*.—*Pyrola* has been found serviceable in the various disorders of the urinary organs, in which the *Uva-ursi* frequently proves beneficial; such as cystirrhœa and calculous complaints. It has occasionally alleviated some cases of hæmaturia, ischuria, dysury, and gonorrhœa.

3. *In scrofula*.—We can readily believe that, as a tonic, this remedy may be useful in various forms of scrofula. But it has been supposed by some to possess almost specific powers; and in America its reputation is so high, that in the provinces it acquired the title of "*King's Cure*." Dr. Paris³ says that "an irregular practitioner, who has persuaded a number of persons in this metropolis that he possesses remedies obtained from the American Indians, by which he is enabled to cure scrofula in its worst forms," relies for success on *chimaphila*. In some ill-conditioned scrofulous ulcers *pyrola* is used in the form of a wash.

ADMINISTRATION.—*Chimaphila* is given in the form of *decoction* or *extract*; the latter has been employed in doses of ten or fifteen grains.

DECOCTUM CHIMAPHILÆ, L. [U. S.]; *Decoctum Pyrolæ*, D.; *Decoction of Umbellated Winter-Green*.—(*Chimaphila* ʒj; Distilled Water Oiss. Boil down to a pint and strain, L.—The *Dublin College* orders of Leaves of Winter-Green, dried, ʒss; Water Oss. Boil for ten minutes in a covered vessel, and strain.)—Dose fʒj to fʒij.

ORDER LII. ERICACEÆ, *Lindley*.—HEATHWORTS.

ERICÆ, *Juss.*—ERICÆÆ, *R. Brown.*

CHARACTERS—*Calyx* 4- or 5-partite, almost equal, entirely unadherent to the ovary, persistent. *Corolla* perigynous, or somewhat hypogynous, gamopetalous. 4- or 5-partite, or with 4 or 5 distinct petals, regular or more rarely irregular petals imbricated by aestivation. *Stamens* definite, equal or double in number to the petals, entirely or almost free from the corolla. *Anthers* 2-celled; cells hard, dry, separate either at the apex or base, often furnished with some appendage, dehiscing by a terminal pore. *Ovary* free, surrounded at the base by a disk, which is sometimes nectariferous. *Style* single, rigid. *Sigma* untrilobed, toothed, or 3 lobed. *Fruit*, capsular, many seeded, many-celled; dehiscence varies. *Seeds* inserted in a central placenta, small, indefinite; the testa firmly adhering to the nucleus. *Embryo* round; in the axis of fleshy albumen; the radicle opposite to the hilum.—*Shrubs* or *under shrubs*, rarely small *trees*. *Leaves* alternate, rarely somewhat opposite or verticillate, without stipules, usually rigid, entire, evergreen, articulated on the stem. (*De Cand*)

PROPERTIES.—The medicinal qualities of the officinal heathworts are due to tannic acid (as in *Uva-ursi*), and to volatile oil (as in *Gaultheria procumbens*). In the tribe *Rhodoræ* are found

¹ *Med.-Chir. Trans.* v. 340.

² *Trans. of the King and Queen's Coll. of Phys. Ireland*, vol. iv. p. 23.

³ *Pharmacologia*.

several species remarkable for their narcotic and poisonous properties; as *Kalmia latifolia*, *Rhododendron chrysanthum*, and *Azalea pontica*. The poisonous properties of Trebizond honey are due to the latter plant (see *Honey*).

208. ARCTOSTAPHYLOS UVA-URSI, Sprengel.—THE BEAR-BERRY.

Arbutus Uva-ursi, Linn.

Sex. Syst. Decandria, Monogynia.

(*Folium. L.*—Leaves, *E. D.*)

HISTORY.—Some doubt exists whether this plant was known to the ancient Greeks and Romans. Baubin¹ and some others think that it is the *ἰδαία ῥίζα* of Dioscorides;² but the leaves are very unlike those of *Ruscus aculeatus* (*ὀξυμύρινη*), to which he, as well as Pliny,³ compares them. The *ἀρκτου σταφυλή* of Galen agrees better with the *Uva-ursi*, though the short description of it applies also to *Ribes rubrum*.⁴

BOTANY. Gen. Char.—*Calyx* 5-partite. *Corolla* ovate-urceolate; the mouth 5-toothed, revolute, short. *Stamens* 10, inclosed; *filaments* somewhat dilated at the base, hairy-ciliate; *anthers* compressed, with two pores at the point, laterally 2-awned, awns reflexed. *Ovarium* globose-depressed, surrounded with 3 scales; *style* short; *stigma* obtuse. *Berry* (or berried drupe) globose, 5-, rarely 6-, 7-, 10-celled; cells 1-seeded. (*De Cand.*)

Sp. Char.—Procumbent. *Leaves* coriaceous, persistent, obovate, quite entire, shining. *Flowers* disposed in terminal small racemes. *Bractlets*, beneath the pedicels, obtuse, small. (*De Cand.*)

Stems woody, round, and trailing. *Leaves* alternate, stalked, evergreen; convex and wrinkled above; concave and paler beneath. *Bractlets* coloured. *Sepals* pale-reddish, permanent. *Corolla* rose-coloured, smooth. *Berry* globose, scarlet, mealy within, very austere, and astringent. *Seeds* seldom more than 4 or 5, though there are the rudiments of 8 or 10.

Hab.—Indigenous. Northern parts of Europe, Asia, and America. On dry, stony, and alpine heaths.

DESCRIPTION.—The dried leaves (*folia uvæ ursi*) are of a dark, shining, green colour, and have a bitter astringent taste, but no odour. Their under surface is reticulated.

The leaves of *Vaccinium Vitis Idæa* (*Red Whortleberry*) are said to be occasionally substituted for those of *Uva-ursi*. The fraud (which is unlikely to occur in this country) may be detected by the edges of the leaves being minutely toothed, and the under surface dotted; whereas the edges are entire, and the under surface reticulated in the genuine leaves. Furthermore, the false leaves are deficient in astringency, and their watery infusion is coloured green by sesquichloride of iron, but does not form any precipitate with gelatin; whereas, the true ones are highly astringent, and their watery infusion forms a blackish-blue precipitate with the sesquichloride of iron.⁵

COMPOSITION.—*Uva-ursi* leaves were analyzed, in 1809, by MM. Melandri and Moretti,⁶ and in 1827 by Meissner.⁷ The constituents in 103 parts are, according to the last-named chemist, *gallic acid* 1.2, *tannic with some gallic acid* 36.4, *resin* 4.4, *oxidized extractive, with some citrate (?) of lime*, 6.8, *gum with supermalates of lime and soda, and traces of tannin and common salt*, 3.3, *chlorophylle* 6.3, *gum (pectic acid ?) extracted by potash* 15.7, *extractive obtained by potash* 17.6, *lignin* 9.6, and *water* 6.0 (excess 1.3).

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—Most animals refuse to

¹ Pinax, p. 470.

² Hist. Nat. lib. xxviii. cap. 69, ed. Valp.

³ See Braconnot, Bull. de Pharm. iii. 348; and Bouillon-Lagrange, Ann. d. Chim. iv. 46.

⁴ Bull. de Pharm. i. 59.

⁵ Lib. iv. cap. 44.

⁶ Murray, De Uva-ursi; Opuscula, 19—20

⁷ Gmelin, Handb. d. Chem. ii. 1294.

eat this plant; there are, however, some few exceptions to this statement. Birds, it is said, will eat the berries; and Murray¹ tells us that two kinds of insects feed on the plant, one of which (a species of *Coccus*) yields a crimson dye. Girardi² found that an infusion of the leaves might be injected into the urinary bladder of animals with impunity; but, when taken internally, it excited vomiting and contraction and inflammation of the stomach.

β. *On Man*.—The obvious effects of *Uva-ursi* are those of the vegetable astringents before described (see vol. i. p. 243). Its activity as an astringent depends on tannic and gallic acids. The former of these acids, in its passage through the system, becomes oxidized and converted into gallic and pyrogallic acids, and humus-like substances, which communicate a dark colour to the urine (see *ante*, p. 326.)

Uva-ursi slightly augments the quantity, and also somewhat modifies the quality of the urine. Alexander³ found that ʒss of the powder acted as a mild diuretic (see vol. i. p. 279); and I have frequently seen lithic deposits in the urine lessen under its use. In large doses the powder readily nauseates.

USES.—As an astringent, it is applicable to all the purposes for which the vegetable astringents generally are used (see vol. i. p. 200). It has been employed as an antidote in poisoning by *ipecacuanha* (see *Ipecacuanha*). But the principal use of this remedy is in *chronic affections of the bladder*, attended with increased secretion of mucus, and unaccompanied with any marks of active inflammation. Thus, in the latter stages of *catarrhus vesicæ*, the continued use of *Uva-ursi* is frequently most beneficial. Combined with *hyoscyamus*, says Dr. Prout,⁴ and persevered in steadily for a considerable time, it seldom fails to diminish the irritation and quantity of mucus, and thus to mitigate the sufferings of the patients. "It undoubtedly possesses," he adds, "considerable powers in chronic affections of the bladder, for which only it is adapted, its operation being slow and requiring perseverance." Sir Benjamin Brodie,⁵ on the other hand, observes that "*Uva-ursi* has the reputation of being useful in some cases of chronic disease of the bladder, and in this [inflammation] among the rest. I must say, however, that I have been disappointed in the use of *Uva-ursi*, and that I have not seen those advantages produced by it which the general reputation of the medicine had led me to expect. I have seen much more good done by a very old medicine"—the root of the *Cissampelos Pareira*. Such are the opposite statements of the effects of this remedy, made by two of the most eminent writers on diseases of the urinary organs. My own experience of it amounts to this: that in some cases the relief obtained by the use of it was marked; whereas, in other instances, it was of no avail. It is to be remembered that its astringent operation unfits it for acute cases, and that the alteration which it produces in the condition of the urinary organs is effected very slowly; so that, to be beneficial, it requires to be exhibited for a considerable period. In *calculus affections* it has occasionally given relief. De Haen⁶ and Van Swieten⁷ speak of the good effects of it in these cases. It alleviated the pain, checked the purulent and mucous secretion, and restored the urine to its natural condition. These effects seem to have arisen from its influence over the kidneys and bladder, for it did not appear to affect the calculus. I have already stated that it has appeared to me to lessen lithic deposits in the urine. In *chronic bronchial affections*, with profuse mucous or purulent secretion, it may occasionally prove serviceable. Dr. Bourne⁸ gave it in powder (in doses of from 8 to 20 grs.) three times daily, in milk, with success.

ADMINISTRATION.—The dose of the powder is from ʒj to ʒj. But the "powdered leaves of this plant are so bulky and disagreeable, that few stomachs will bear to persevere long enough in the use of the requisite quantity; and the case is pretty

¹ *Opuscula*, p. 98.

² *De Uva Ursina* [Sandifort, *Thesaurus*, ii. 453]. Patavi. 1764.

³ *On Affect of the Urinary Organs*, pp. 185 and 268, 2d edit. 1825.

⁴ *Lond. Med. Gaz.* vol. i. p. 300.

⁵ *Commentaries*, t. xvi. p. 300.

⁶ *Cases of Pulmonary Consumption, &c. treated with Uva-ursi*, 1805.

⁷ *Exp. Essays*, p. 151.

⁸ *Rat. Med.* t. ii. p. 63.

much the same with the infusion and decoction."¹ On this account the extract is frequently preferred.

1. *DECOCTUM UVAE URSI*, L. D. [U. S.]; *Decoction of Bear-berry*.—(Uva-ursi $\bar{5}$ j; Distilled Water Oiss. Boil down to a pint and strain, L.—The *Dublin College* orders of Uva-ursi $\bar{3}$ ss; Water Oss. Boil for ten minutes in a covered vessel and strain.)—Dose, $\bar{f}\bar{3}$ j to $\bar{f}\bar{3}$ ij, three times a day.

2. *EXTRACTUM UVAE URSI*, L.; *Extract of Bear-berry*.—(Uva-ursi, bruised, libiiss; Boiling Distilled Water Cong. ij. Macerate for twenty-four hours; then boil down to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence.)—Dose, grs. v to grs. xv twice or thrice daily.

209. *Gaultheria procumbens*, Linn.—Partridge-Berry.

Sex. Syst. Decandria, Monogynia.

(Leaves.)

Gaultheria repens, Rafinesque,² Med. Fl. of the United States. In different parts of the United States it is known by different names; as *Grouse-berry*, *Deer-berry*, *Spice-berry*, *Tea berry*, *Mountain-tea*, *Winter-green*, *Box-berry*, &c.

A small shrubby evergreen. Stem prostrate, smooth; with ascending branches. Leaves obovate, with setaceous serratures, acute at either end. Pedicels bearing 1—2 nodding flowers. Calyx 5-lobed, white. Corolla white, urceolate. Capsule small, 5 celled, inclosed within the fleshy calyx, and presenting the appearance of a bright scarlet berry. Grows in America from Canada to Virginia.

The leaves and other parts of the plant contain a peculiar volatile oil (oil of partridge-berry or oil of winter-green), to which their aromatic qualities are due. The leaves also contain tannin.

The leaves are aromatic, stimulant, and astringent. In infusion they have been employed, under the name of *Mountain or Salvador Tea*, as a substitute for China tea. Like some other stimulants, they have been thought to promote the catamenia and milk. As astringents, they have been used in chronic diarrhœa. But they are chiefly employed on account of their agreeable flavour, and to yield the essential oil.

The volatile oil of partridge berry (*oleum gaultheriæ*, Ph. United States) has occasionally been imported, and sold in England under the name of *oil of winter green*. It is obtained chiefly in New Jersey, by submitting the leaves of the plant to distillation with water. As usually met with in commerce, it has a brownish-yellow or pinkish colour; that which I have met with in England was pinkish-yellow. By redistillation it becomes colourless. It is the heaviest of all the volatile oils; its sp. gr. being 1.173 at 50° F.; and this character, therefore, becomes a test of the purity of the oil. Its boiling point is 412°.³ Its taste is sweetish, pungent, and peculiar, its odour characteristic and agreeable. It solidifies when dropped into a solution of potash or soda. The aqueous solution of the oil assumes, on the addition of a persalt of iron, a violet colour (*salicylate of the peroxide of iron*). The commercial oil consists, according to Cahours,⁴ of two volatile oils—one light, the other heavy. The light oil of partridge-berry or gaultherylene ($C^{20}H^{16}$), constitutes about $\frac{1}{10}$ th part of the commercial oil, and forms the first portion which distils over. It is a colourless, very limpid oil, with an agreeable odour, approximating to that of oil of pepper. It boils at 417° F. It is isomeric with oil of turpentine. The heavy oil of partridge berry, gaultheric acid, or salicylate of methylene (C^8H^8O . $C^{14}H^{10}O^5$), constitutes $\frac{9}{10}$ ths of the commercial oil. It is a colourless liquid, having a sp. gr. of 1.18 at 50° F., and a warm and aromatic taste. It dissolves in all proportions in alcohol and ether, and slightly so in water. It combines with bases to form salts (*gaultherates*).

The commercial oil of partridge-berry is an aromatic stimulant, and is chiefly used to cover the unpleasant flavour of other medicines (see *Syrup of Sarsaparilla*, p. 279). Like other essential oils, it is sometimes employed to allay toothache. In the dose of a fluidounce it has caused death; on examination of the body, strong marks of inflammation of the stomach were discovered.⁵ The *essence*, prepared by dissolving the oil in rectified spirit, is sometimes employed as a cordial and stimulant.

¹ Prout, *op. cit.* p. 185.

² Rafinesque observes that this plant was dedicated to Dr. Gautier, of Canada, by Kalin, wrongly mis-spelt *Gaultheria* and *Gualtheria*; and that it is creeping, not procumbent; hence, he proposed to change the name from *Gaultheria procumbens* to *Gautiera repens*.

³ Mr. Procter, Jun., *Am. Journ. of Pharm.* iii. and xiv.

⁴ *Ann. d. Chim. et Phys.* 3me sér. t. x. p. 327.

⁵ *United States Dispensatory* (*Journ. of Phil. Col. of Pharm.* vi. 290).

ORDER LIII. LOBELIACEÆ, *Jussieu*.—LOBELIADS.

CHARACTERS.—*Calyx* 5-lobed, more or less adherent to the ovary. *Corolla* persistent, more or less gamopetalous; *lobes* or petals 5, usually irregular, sometimes almost regular; *tubes* entire or cleft longitudinally. *Estivation* somewhat valvular. *Stamens* 5, alternate with the lobes of the corolla, usually free, but sometimes adherent to the tube of the corolla; *filaments* free, or more or less connate; *anthers* cohering, bilocular, dehiscing longitudinally; *pollen* ovoid. *Ovary* inferior or semi-superior, 2- or rarely 1-celled, then with parietal placentæ; *style* 1; *stigma* surrounded with a ring of hairs: *Fruit* usually dehiscing at the apex by 2 valves, rarely from above by an operculum, or laterally by 3 valves, or indehiscent. *Seeds* indefinite; *albumen* fleshy; *embryo* straight—*Lactescent herbs* or *under-shrubs*, rarely small *trees*. *Leaves* alternate, without stipules. *Flowers* usually axillary, solitary, racemose. (Condensed from De Cand.)

PROPERTIES.—Dangerous or suspicious plants; mostly acrids or acro-narcotics.

210. LOBELIA INFLATA, *Linn.*—BLADDER-PODDED LOBELIA; INDIAN TOBACCO.

Sex. Syst. Pentandria, Monogynia.

(*Herba florens*, *L.*—*Herb*, *E. D.*)

HISTORY.—This plant was employed by the aborigines in America; and after having been for some time used by quacks, was introduced to the notice of the profession by the Rev. Dr. Cutler, of Massachusetts.¹ It was introduced into England, in 1829, by Dr. Reece.²

BOTANY. *Gen. Char.*—*Calyx* 5-lobed; the tube obconical, ovoid or hemispherical. *Corolla* cleft longitudinally from above, bilabiate; the *tube* cylindrical or funnel-shaped, straight; the *upper lip* usually smaller, and erect; the *lower* generally spreading, broader, 3-cleft, or more rarely 3-toothed. The 2 inferior or occasionally all of the *anthers*, barbed at the point. *Ovary* inferior or semi-superior, and (in species very much alike) somewhat free. (*De Cand.*)

Sp. Char.—*Stem* erect, the lower part simple and shaggy; the upper part racemose and smooth. *Leaves* irregularly serrate-dentate, hairy; the lower ones oblong, obtuse, shortly petioled; the middle ones ovate-acute, sessile. *Flowers* small, racemose. *Pedicels* short, with an acuminate bract. *Calyx* smooth, the *tube* ovoid; the lobes linear-acuminate, equal to the corolla. *Capsule* ovoid, inflated. (*De Cand.*)

Annual; height, a foot or more. *Root* fibrous. *Stem* angular. *Leaves* scattered; segments of the *calyx* linear, pointed. *Corolla* delicate blue. *Anthers* collected into an oblong curved body, purple; *filaments* white. *Style* filiform; *stigma* curved, and inclosed by the anthers. *Capsule* 2-celled, 10-angled, crowned with the calyx. *Seeds* (Fig. 320) numerous, small (about $\frac{1}{3}$ of an inch long, and $\frac{1}{8}$ of an inch broad), brown, oblong, oval or almond-shaped, reticulated with brown fibres, the interspaces irregular in shape, and yellow.

Hab.—North America, from Canada to Carolina and the Mississippi. Begins to flower in July. The plant should be collected in August or September.

DESCRIPTION.—Both the flowering herb and seeds are imported from America, and are found in the shops.

1. The *flowering herb* (*herba florens lobeliæ inflatæ*) is chiefly prepared by the Shaking Quakers of New Lebanon, North America. It has been compressed into oblong cakes, weighing either half a pound or a pound each, and enveloped in blue paper.

Fig. 320.

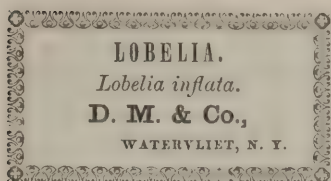


Seed of *Lobelia inflata* magnified.

¹ *Thacher's Amer. New Dispensatory*, 2d ed. p. 258.

² *Pract. Treat. on the Anti-asthmatic Properties of Bladder-podded Lobelia*, 1829.

The packages imported by Mr. M'Culloch, of Covent Garden Market, have a label on them, of which the adjoined is a copy.



The dried herb is pale greenish-yellow; its smell is somewhat nauseous and irritating; its taste burning and acrid, very similar to that of tobacco. Its powder (*pulvis lobeliæ*) is greenish, and somewhat resembles powdered senna leaves.

2. The seeds (*semina lobeliæ inflatæ*) have been already described. Their powder (*pulvis seminum lobeliæ inflatæ*) is brown, somewhat resembling rappee, but scarcely so uniform in colour, and communicates a greasy stain to paper. When examined by the microscope, this powder is found to consist chiefly of broken seeds, but intermixed with some whole ones.

DESCRIPTION.—This plant was first examined chemically by Dr. Colhoun,¹ and afterwards by Mr. Wm. Procter, Jun.² In the second edition of the present work (1842), I published the results of a few experiments made with the view of determining the composition of this plant. A more complete analysis of it was made by Reinsch³ in 1843. Very recently, Mr. Bastick⁴ has published some experiments made with the object of isolating the active principle.

Procter's Analysis.	Pereira's Analysis.	Reinsch's Analysis.
A peculiar acrid alkaline principle.	Volatile principle.	Water 11 0
Resin.	Lobelina.	Volatile oil not determined
Chlorophylle.	Lobelic acid.	Alcoholic extract—
Gum.	Resin.	Chlorophylle } 5 5
Gallie [lobelic] acid.	Chlorophylle.	Wax }
Fixed oil.	Gum.	Resin }
Salts of lime.	Extractive.	Stearine 2 2
Salts of potash.	Caoutchouc?	Peculiar substance (<i>Lobelin</i>) 1 3
Oxide of iron.	Woody fibre.	Aromatic resin 1 3
Lignin.		Vegetable gluten 2 5
		Aqueous extract—
		Gum 6 0
		Potash, lime, magnesia, iron, and manganese salts, with organic and inorganic acids 2 4
		Extracted by potash—
		Gum 42 4
		Vegetable fibre 26 6
		100 2

1. VOLATILE OIL OF LOBELIA; *Odeorous Principle of Lobelia*; *Lobelianin*.—Water distilled from lobelia has the peculiar smell, and in my former experiments appeared to me to possess also the nauseous, acrid taste of the plant; but Mr. Procter, Jun. declares it to be devoid of acrimony, and Reinsch states that the oil which comes over on the water has a bland taste and a moderately strong odour. In one experiment, I obtained a thin film of what appeared to be a solid volatile oil. The distilled water of lobelia is unaffected by acids, sesquichloride of iron, and tincture of nutgalls.

2. LOBELINA; *Lobelin*; *Peculiar Acrid Alkaline Principle*.—The existence of this principle was first announced, though not isolated, by Dr. Colhoun. According to Mr. Procter, it is found in the seeds in larger proportion than in the herb. From twelve ounces of the former he obtained eighteen and a half grains of lobelina. He procured it by treating the seeds with alcohol acidulated with acetic acid until deprived of their acrimony. The tincture was evaporated to the consistence of an extract which was triturated with magnesia and water, and after repeated agitation with water, the liquor which held lobelina in solution was filtered and shaken repeatedly with ether until deprived of acrimony; the ethereal solution was then decanted and allowed to evaporate spontaneously. The impure lobelina thus obtained was dissolved in water by the aid of sulphuric acid, the solution decolorized by animal charcoal, and then mixed with magnesia. The liquor was then agitated with ether to dissolve the lobelina which had been set free, and the ethereal solution allowed to evaporate spontaneously.

Mr. Bastick's process for obtaining it is similar to that recommended by Liebig for procuring hyoscyamia.

Lobelina is a liquid alkaloid, of a light yellow colour and somewhat aromatic odour. It is

¹ *Journal of the Philadelphia College of Pharmacy*, Jan. 1834; and *Journ. de Pharmacie*, t. xx. p. 545. 1834.

² *American Journal of Pharmacy*, vol. ix. p. 99, 1833; and vol. xiii. p. 1. Also, *Pharmaceut. Journ* vol. x. pp. 454 and 456.

³ *Pharmaceutical Journal*, vol. iii. p. 129, 1843.

⁴ *Ibid.* vol. x. p. 270, 1850.

lighter than water, on which fluid it floats. It is soluble in water, but more so in alcohol and ether. It is also soluble in oil of turpentine and oil of sweet almonds. It has an alkaline reaction on reddened litmus paper, and unites with sulphuric, nitric, hydrochloric, oxalic, and lobelic acids, to form crystallizable salts, which are more soluble in water than the alkaloid itself. Tannic acid throws it down from its solution in the form of a white bitannate. Mr. Bastick says lobelina is volatile, but does not evaporate entirely unchanged. Lobelina is the active principle of the plant, but is not so active as nicotine. A quarter of a grain excited vomiting and much prostration in a cat. A grain caused immediate and total prostration, which for half an hour rendered the animal almost motionless, and caused dilatation of the pupils.

3. **LOBELIC ACID.**—In 1842, I drew attention to the peculiarity of this acid, to which I gave the name it now bears; and Mr. W. Procter, Jun. has subsequently confirmed my statements. It had previously been confounded with gallic acid. With the persalts of iron, a solution of lobelic acid causes an olive-brown precipitate,¹ with sulphate of copper a pale green, with nitrate of silver a brownish precipitate soluble in nitric acid, with either acetate or diacetate of lead yellow, and with protonitrate of mercury a yellowish-white precipitate. A solution of gelatin had no effect on it. According to Mr. Procter, the acid is crystallizable and soluble in ether.

4. **RESIN.**—By gently evaporating the tincture of lobelia (prepared with proof spirit), a resinous substance separates and floats on the surface of the liquid. It has an exceedingly acid taste.

CHARACTERISTICS.—As death is not unfrequently the consequence of the empirical use of lobelia, it is desirable that we should possess some means of detecting the poison. I am, however, unacquainted with any chemical characteristics by which it can be recognized. The following are some of its reactions: A decoction of lobelia reddens litmus, and, if strong, lets fall a precipitate (*gum*) when dropped into rectified spirit. Infusion of nutgalls throws down a pale yellowish-white or grayish precipitate (*impure tannate of lobelina*). In its reactions on solutions of metallic salts, it agrees with a solution of lobelic acid before described.

The tobacco-like flavour of the powder and decoction, and the remarkable acid sensation, like that caused by tobacco, which these preparations excite in the fauces, may sometimes aid in recognizing them.

Mr. Frederick Curtis² has drawn attention to the microscopic characters of the seeds as a means of detecting the herb of lobelia, or its powder; as these seeds, on account of their minuteness, escape complete destruction by the mill or mortar. I have, however, been unable to detect any seeds or fragments of seeds in the *pulvis lobeliæ* sold at an herb-shop in London; the herb which is sent to the mill not being sufficiently ripe to contain seeds; but the *pulvis seminum lobeliæ* may be readily detected by the microscope. When the ordinary lobelia powder contains seeds, or fragments of seeds, no difficulty will be found in recognizing them by the microscope. Mr. Curtis recommends the powder to be sifted in order to separate the coarser from the finer particles; and he says that the uninjured seeds will be left on a sieve whose apertures are $\frac{1}{15}$ th of an inch (see *ante*, p. 583, Fig. 320). Mr. Curtis describes the seeds as having "oblong-square" reticulations. Dr. Otto Berg³ has also depicted these spaces as being rectangular. I have, however, found them irregular in shape, as shown in Fig. 320.

PHYSIOLOGICAL EFFECTS.—An accurate account of the effects of this plant on man and animals is yet wanting; but, from the observations hitherto made, its operation appears to be very similar to, but milder than, that of tobacco (see *ante*, p. 494); and from this circumstance, indeed, it has been called the *Indian Tobacco*. I have before remarked, that both in its taste and in the sensation of acidity which it excites in the throat, it resembles common tobacco. This analogy between nicotiana and lobelia, originally noticed by the American practitioners, is confirmed by Dr. Elliotson.⁴

a. *On Animals generally.*—Horses and cattle have been supposed to be killed by

¹ The effect produced by persalts of iron on this acid is analogous to that caused by the same agents on *lous* (see *ante*, p. 201) and *cebadilla* (see *ante*, p. 189).

² *Lond. Medical Gazette*, July 25, 1851.

³ *Ursatzkristall der für die Arzneikunde und Technik wichtigsten Pflanzen-Genera*, 2ter Abdruck, 1851.

⁴ *Lancet*, April 15, 1837, p. 144.

eating it accidentally.¹ An extraordinary flow of saliva is said to be produced by it in cattle.² Hedgehogs and cats are killed by it.³

β. *On Man*.—αα. In small doses it operates as a *diaphoretic* and *expectorant*. Mr. Andrews,⁴ who speaks from its effects on himself, says it has “the peculiar soothing quality of exciting expectoration without the pain of coughing.”

ββ. In full medicinal doses (as ℥j of the powder) it acts as a powerful *nauseating emetic*. Hence, it has been called the *emetic weed*. It causes severe and speedy vomiting, attended with continued and distressing nausea, sometimes purging, copious sweating, and great general relaxation. These symptoms are usually preceded by giddiness, headache, and general tremors. The Rev. Dr. M. Cutler,⁵ in his account of the effects on himself, says that, taken during a severe paroxysm of asthma, it caused sickness and vomiting, and a kind of prickly sensation through the whole system, even to the extremities of the fingers and toes. The urinary passage was perceptibly affected, by producing a smarting sensation in passing urine, which was probably provoked by stimulus on the bladder. It sometimes, as in the Rev. Dr. Cutler’s case, gives almost instantaneous relief in an attack of spasmodic asthma. Intermittent pulse was caused by it in a case mentioned by Dr. Elliotson. Administered by the rectum it produces the same distressing sickness of stomach, profuse perspiration, and universal relaxation, which result from a similar use of tobacco.

γγ. In excessive doses, or in full doses too frequently repeated, its effects are those of a powerful *acero-narcotic poison*. “The melancholy consequences resulting from the use of *Lobelia inflata*,” says Dr. Thacher,⁶ “as lately administered by the adventurous hands of a noted empiric,⁷ have justly excited considerable interest, and furnished alarming examples of its deleterious properties and fatal effects. The dose in which he is said usually to prescribe it, and frequently with impunity, is a common teaspoonful of the powdered seeds or leaves, and often repeated. If the medicine does not puke or evacuate powerfully, it frequently destroys the patient, and sometimes in five or six hours.” Its effects, according to Dr. Wood,⁸ are “extreme prostration, great anxiety and distress, and ultimately death, preceded by convulsions.” He also tells us that fatal results (in America) have been experienced from its empirical use. These are the more apt to occur when the poison, as is sometimes the case, is not rejected by vomiting.

Within the last three years, several cases⁹ of poisoning by lobelia have occurred in England, in consequence of the administration of this agent by ignorant persons acting under the guidance or instruction of a notorious empiric.¹⁰

USES.—*Lobelia* is probably applicable to all the purposes for which tobacco has been used (see *ante*, p. 492). From my own observation of its effects, its principal value is as an *antispasmodic*.

1. In *asthma* (especially the *spasmodic kind*) and other disorders of the organs of respiration.—Given in full doses, so as to excite nausea and vomiting, at the commencement of, or shortly before, an attack of *spasmodic asthma*, it sometimes succeeds in cutting short the paroxysm, or in greatly mitigating its violence; at other times, however, it completely fails. Occasionally, it has proved serviceable in a few attacks, and, by repetition, has lost its influence over the disease.

To obtain its beneficial influence in asthma, it is not necessary, however, to give

¹ Thacher, *American New Dispensatory*, p. 2.

² *Lancet*, May 13, 1837, p. 299.

³ See the experiments of Mr. Curtis and Dr. Pearson in the *Lond. Med. Gaz.* Aug. 16, 1850.

⁴ *Lond. Medical Gazette*, vol. iii. p. 260.

⁵ Thacher, *op. cit.*

⁶ *Op. cit.*

⁷ The empiric alluded to by Dr. Thacher is Samuel Thomson, the author of a work entitled “*The Thomsonian Materia Medica, or Botanic Family Physician*,” 12th ed. 8vo. Albany, 1841.

⁸ *United States Dispensatory*.

⁹ See *Lond. Medical Gazette* for Aug. 31, 1849, and Aug. 30, 1850; also, *Lancet* for Sept. 8, 1849, and June 22, 1850; and *Pharmaceutical Journal* for Aug. 1851.

¹⁰ The founder of what has been called “*Coffinism*,” (see *Pharmaceutical Journ.* Sept. 1, 1849, and Feb. 1, 1851)—an individual who styles himself “A. J. Coffin, M. D., Professor of Medical Botany,” declares in his “*Botanic Guide to Health and the Natural Pathology of Disease*,” 17th ed. 1850, that *Lobelia* is not a poison; and “that it never operates upon those who are in perfect health;” and he says that the powdered leaves or pods may be given in doses of a teaspoonful every half hour, in a cup of warm tea or pennyroyal, and repeated until it operates as an emetic; and he adds: “Never mind Hooper, but give enough!”

it in doses sufficient to excite vomiting. Dr. Elliotson¹ recommends the use of small doses at the commencement, and says that these should be gradually increased if neither headache nor vomiting occur; but immediately these symptoms come on, the use of the remedy is to be omitted. Given in this way, I can testify to its good effects in spasmodic asthma. It has also been used in *croup*, *hooping-cough*, and *catharrhal asthma*, but with no very encouraging effects.

2. In *strangulated hernia*, Dr. Eberle² employed it effectually, instead of tobacco, in the form of enema.

3. As an *emetic*, it has been employed by Dr. Eberle³ in *croup*; but its operation is too distressing and dangerous for ordinary use.

ADMINISTRATION.—It may be given in *powder*, *infusion*, or *tincture* (alcoholic or ethereal). Dr. Reece employed an *oxymel*. The dose of the *powder*, as an emetic, is from grs. x to ℥j; as an expectorant, from gr. j to grs. v. It deserves especial notice that the effects of lobelia are very unequal on different persons, and that some are exceedingly susceptible of its influence.⁴

ANTIDOTES.—See antidotes for tobacco, p. 496. After the poison has been evacuated from the stomach, opium and demulcents may be used to allay the gastrointestinal irritation.

1. TINCTURA LOBELIÆ, L. E. D. [U. S.]; *Tincture of Lobelia*.—(Lobelia, dried and powdered [in moderately fine powder, *E.*; in coarse powder, *D.*] ℥v; Proof Spirit Oij. [Lobelia ℥iv; Diluted Alcohol Oij. Macerate for fourteen days, express and filter through paper, *U. S.*] This tincture is best prepared by the process of percolation, as directed for the tincture of capsicum; but it may also be made in the usual way by digestion, *E.*)—Dose, as an emetic and antispasmodic, from f℥j to f℥ij, repeated every two or three hours until vomiting occur; as an expectorant, ℞x to f℥j. For children of one or two years old, the dose is ℞x to ℞xx.

2. TINCTURA LOBELIÆ ÆTHEREA, L. E.; *Ethereal Tincture of Lobelia*.—(Lobelia, in powder, ℥v; Æther f℥xiv; Rectified Spirit f℥xxvj. Macerate for seven days; then express and strain, *L.*—Lobelia, dried, and in moderately fine powder, ℥v; Spirit of Sulphuric Ether Oij. This tincture is best prepared by percolation, as directed for tincture of capsicum; but it may also be obtained by digestion in a well-closed vessel for seven days, *E.*)—This may be used in the same doses as the alcoholic tincture.

With some persons the ether is apt to disagree, and for such the alcoholic tincture is preferred. *Whitlaw's ethereal tincture*, used by Dr. Elliotson, consisted of Lobelia ℥bj; Rectified Spirit Oiv; Spirit of Nitric Ether Oiv; Spirit of Sulphuric Ether ℥iv. Macerate for fourteen days in a dark place.⁵

211. Lobelia syphilitica, Linn.—Blue Cardinal.

(Radix.)

This plant is a native of the United States of America. It possesses emetic, cathartic, and diuretic properties; and derived its specific name from its supposed efficacy in syphilis, as experienced by the North American Indians, who considered it a specific in that disease, and from whom the secret of its use was purchased by Sir W. Johnson.⁶ Its antisiphilitic powers appear to have no foundation in fact.⁷ The root was the part used; it was given in the form of decoction, prepared by boiling half an ounce of the root in twelve pints of water down to one-third. The dose is a wineglassful.

¹ *Lancet*, April 15, 1837, p. 144.

² *Op. cit.*

³ *Lancet*, June 3, 1837.

⁴ Woodville, *Med. Bot.* vol. i. p. 178; see also Murray's *App. Medicaminum*, vol. i. p. 773, ed. alt. 1793.

⁵ Pearson, *Observ. on various Art. of the Mat. Med.* p. 70.

⁶ *Treat. of the Mat. Med.* vol. i. p. 48, 2d ed.

⁷ Elliotson, *Lancet*, June, 1832; and April 15, 1837.

ORDER LIV. COMPOSITÆ, *De Candolle*.—COMPOSITES.SYNANTHEREÆ, *Richard*; ASTERACEÆ, *Lindley*.

CHARACTERS.—*Calyx* gamosepalous, the tube adherent to the ovary; the *limb* generally developed into a pappus, or sometimes into a scaly corona, or entirely abortive. *Pappus* simple, pilose, ramose, or plumose; stipitate by the prolongation of the tube beyond the ovary, or sessile. *Corolla* inserted into the upper part of the tube of the calyx, gamopetalous; the nerves in the tube being directed towards the sinuses; in appearance 5, but really 10; which then proceed from the sinuses, along the margins of the lobes, to the apex, where they inscuate [*neuramphipetalous*]. *Tube* various in length; in the regular corolla, often funnel-shaped. *Lobes* generally 5, valvate in æstivation. *Corolla* regular or irregular; the regular, of 5 equal lobes (*tubular corolla*); the irregular 2-lipped (*bilabiate corolla*) or strap shaped, 5-dentate (*ligulate corolla*). *Stamens* generally 5; in the female florets wanting, or rudimentary. *Filaments* adnate to the tube of the corolla; distinct or monadelphous; articulated near the apex, the upper portion acting as a connective. *Anthers* erect; connected in the tube, which is perforated by the style (*syngenesious* or *synantherous*). *Pollen* rough or smooth, globose or elliptical. *Ovary* adherent to the calyx, 1-seeded. *Style* generally terete and bifid at the apex; the branches (commonly called *stigmas*) more or less free; flat above, convex beneath. *Stigmatic glands* (*true stigmas*) ranged in a double row along the upper margin of the branches of the style, more or less prominent; the upper portion of the style, in hermaphrodite flowers provided with hairs, which collect the pollen. *Fruit* consisting of an achene and calyx closely connected, and inclosing the embryo; the *achene* 1-celled, articulated on the receptacle, generally sessile; rostrate or not rostrate at the apex. *Seed* attached to the base of the fruit by a very short funiculus. Inner portion of the *spermoderm* (*endopleura* of *De Cand.*, *albumen* of *Lessing*) diaphanous, pierced by the bifid funiculus. *Embryo* erect, with a short, straight, inferior radicle, and an inconspicuous plumule. *Florets* collected into dense heads (*capitules*); either all hermaphrodite (*homogamous*), or the outer ones female or neuter, the inner being hermaphrodite or male (*heterogamous*); or the capitules are entirely composed of florets of distinct sexes (*monœcious, diœcious, heterocephalous*). *Capitules* with the florets sometimes all tubular (*discoid* or *flosculous*); sometimes all ligulate (*ligulate* or *semi-flosculous*): sometimes the central florets are tubular, while those of the ray are ligulate (*radiate*). *Involucre* of one or many rows of more or less united scales, surrounding the receptacle which is formed by the concretion of the extremities of the penduncles; either covered with chaffy scales (*puleaceous*) or naked (*epuleaceous*): sometimes the receptacle is indented with pentagonal hollows (*areolated*), or the margins of these are slightly raised (*alveolated*), or fringed (*fimbriated*). *Herbs* or *shrubs* (rarely *trees*), forming almost a tenth part of the vegetable kingdom. *Leaves* simple, alternate, or opposite. (Condensed from *De Candolle*.)

PROPERTIES.—Variable. A bitter principle pervades most species; this communicates tonic properties. The laxative and anthelmintic qualities possessed by some of the species may, perhaps, depend on the same principle. Volatile oil is frequently present; it communicates aromatic, carminative, diaphoretic, and, in some cases, acrid properties. Bitter matter and volatile oil are often associated in the same plant. An acrid resin is present in some species. A few of the *Compositæ* are narcotic.

Sub-order I. TUBULIFLORÆ, *De Cand.*

Flowers hermaphrodite, regularly tubular, 5-, rarely 4-toothed.

TRIBE I. VERNONIACEÆ.

Style cylindrical, its arms generally long and subulate, occasionally short and blunt, always covered all over with bristles.

This tribe contains no medicine of importance. The fruits (called seeds) of *Vernonia anthelmintica*, Willd., are used in the East Indies, as an anthelmintic, in doses of a drachm and a half.¹ The root of *Elephantopus Martii* is tonic and astringent, and is used in the Brazils in the form of decoction in asthenic fevers.²

¹ Ainslie, *Mat. Indica*, vol. ii. p. 54.—The seeds called *Calagira* or *Calagari*, and erroneously said by Virey (*Journ. de Pharm.* t. xxii. p. 612) to be the produce of *Vernonia anthelmintica*, were the seeds of *Nigella indica* of Roxburgh (*Fl. Ind.* vol. ii. p. 646).

² C. F. P. de Martius, *Syst. Mat. Med. Veg. Brazil*, pp. 9 and 36, 1843.

TRIBE II. EUPATORIACEÆ.

Style cylindrical, its arms long, somewhat clavate, with a papillose surface on the outside, near the end.

Eupatorium perfoliatum, Linn., a native of North America, is a bitter tonic. Its warm infusion acts as a diaphoretic and emetic.¹ A plant called *Guaco* or *Huaco* is held in high estimation in Peru, as a specific against bites of venomous serpents and rabid animals.² It is supposed to be the *Mikania Guaro*, Humb. and Bonpl., which grows in Colombia on the banks of the Magdalena. *Guaco* has also been used in cholera.³ Several plants have been brought to Europe under the name of *guaco*.⁴ Fourc⁵ analyzed one of these, and announced the existence in it of a peculiar resin, to which he gave the name of *guarine*. There can be no doubt that if *guaco* really possesses any therapeutical value whatever, its virtues have been monstrosly exaggerated.

212. Tussilago Farfara, Linn.—Coltsfoot.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia et Flores.)

Βίχιν of Hippocrates (*de intern. affect.*, p. 532; et *de articulis*, p. 829, ed. Fœs.) and Discorides (lib. iii. cap. 124). By the Greeks and Romans it was smoked, to relieve obstinate cough (see *ante*, p. 484).

Rhizome creeping horizontally. Leaves cordate, angular, toothed, downy beneath. Scape clothed with imbricated scaly bracts, usually 1-flowered. Heads appearing before the leaves. Flowers yellow. Indigenous. Various parts of Europe and Asia. Flowers in March and April. The herb and flowers (*herba et flores farfarae seu tussilaginis*) have a bitterish mucilaginous taste. The dried leaves are odourless, but the flowers retain a slight odour. The watery infusion becomes green (*tannate of iron*) on the addition of sesquichloride of iron. No analysis of the plant has yet been made. *Mucilage, bitter extractive, tannic acid, colouring matter, salts, and woody fibre*, are the principal constituents. The effects are not very obvious; they may be regarded as emollient, demulcent, and very slightly tonic. Employed as a popular remedy in pulmonary complaints (chronic coughs, especially). The *decortion* (prepared by boiling ℥j or ℥ij of the plant in Oj of water to Oj) may be taken in doses of ℥ij or ℥ijj, or *ad libitum*.

TRIBE III. ASTEROIDEÆ.

Style cylindrical; its arms linear, flattish on the outside, equally and finally downy on the inside.

213. INULA HELENIUM, Linn.—ELECAMPANE.

Sex. Syst. Syngenesia, Polygamia superflua.

(Radix, L.)

HISTORY.—This is the *ἑλένιον* of Hippocrates⁶ and of Dioscorides.⁷

BOTANY. *Gen. Char.*—*Head* many-flowered, heterogamous; *florets* of the ray females, in one row, sometimes by abortion sterile, usually ligulate, rarely somewhat tubular and trifid; those of the disk hermaphrodite, tubular, 5-toothed. *Involucre* imbricated in several rows. *Receptacle* flat or somewhat convex, naked. *Anthems* with 2 setæ at the base. *Achene* without a beak, tapering, or, in *I. Helenium*, 4-cornered. *Pappus* uniform, in 1 row, composed of capillary, roughish setæ. (*De Cand.*)

Sp. Char.—*Stem* erect. *Leaves* dentate, velvety-tomentose beneath, acute; the radical ones ovate, greatly attenuated into petioles; those of the stem semi-amplexicaul. *Peduncles* few, 1-headed, corymbose at the apex. (*De Cand.*)

¹ Bigelow, *American Medical Botany*, vol. i. p. 33, plate ii. 1817; also Wood, *United States Dispensatory*.

² *Bullet. de Pharm.* t. vi. p. 248, 1814.

³ Dunglison, *New Remedies*, p. 408, 6th ed. 1851.

⁴ Dieblich, *Die neuesten Entdeck. in der Mat. Med.* Bd. i. S. 161, 1837; and Bd. ii. S. 220.

⁵ *Journ. de Pharm.* t. xxii. p. 291, 1836.

⁶ *Nat. Hist.* p. 572, ed. Fœs.

⁷ *Lib.* i. cap. 27.

Root perennial, thick, branching. *Stem* 3 to 5 feet high. *Leaves* large, serrated, veiny. *Heads* terminal. *Flowers* bright-yellow.

HAB.—Indigenous. Various parts of Europe. Flowers in July and August.

DESCRIPTION.—The dried root (*radix helenii seu enulæ*) of the shops consists of longitudinal or transverse slices, which are yellowish-gray, and have an aromatic or camphoraceous smell, and a warm bitter taste. Iodine colours the root brown. Sesquichloride of iron produces in the infusion a green colour (*tannate of iron*).

COMPOSITION.—The root has been analyzed by John,¹ by Funcke,² and by Schulz.³ The constituents, according to John, are—*volatile oil* a trace, *elecampane-camphor* 0.3 to 0.4, *wax* 0.6, *acid soft resin* 1.7, *bitter extractive* 36.7, *gum* 4.5, *inulin* 36.7, *woody fibre* 5.5, *oxidized extractive with coagulated albumen* 13.9; besides *salts of potash, lime, and magnesia*.

1. **HELENIN**; *Elecampane-camphor*.—Colourless prismatic crystals, heavier than water, fusible, volatile, very soluble in ether, oil of turpentine, and boiling alcohol, but insoluble in water. Nitric acid converts it into *resin (nitrohelenin)*. Its formula, according to Dumas, is $C^{14}H^{10}O^2$; according to Gerhardt,⁴ $C^{15}H^{10}O^2$. Its composition, therefore, is closely allied to that of creosote.

2. **RESIN.**—Brown, fusible in boiling water, and soluble in alcohol and ether. When warm it has an aromatic odour. Its taste is bitter, nauseous, and acrid.

3. **INULIN** (*Alantin* and *Menyanthin*, Trommsdorff; *Elecampin*, Henry; *Dahlin* and *Dutiscin*, Payon)—An amylaceous substance, organized, according to Raspail, like common starch. It is very slightly soluble in cold water, but very soluble in boiling water, from which it is deposited as the solution cools. It is slightly soluble in boiling alcohol. Iodine gives it a yellow tint; this distinguishes it from ordinary starch. Its formula is $C^{12}H^{10}O^{10}$. In combination with lead it produces an atom of water, and becomes $C^{12}H^9O^9$.

4. **BITTER EXTRACTIVE.**—In this resides the tonic property of elecampane.

PHYSIOLOGICAL EFFECTS.—An aromatic tonic. It acts as a gentle stimulant to the organs of secretion, and is termed diaphoretic, diuretic, and expectorant. Large doses cause nausea and vomiting. It was formerly supposed to possess emmenagogue properties. In its operation it is allied to sweet-flag (see vol. i. p. 158) and senega.

USES.—It is rarely employed now by the medical practitioner. It has been used in pulmonary affections (as catarrh) attended with profuse secretion and accumulation of mucus, but without febrile disorder or heat of skin. In dyspepsia, attended with relaxation and debility, it has been administered with benefit. It has also been employed in the exanthemata to promote the eruption.

ADMINISTRATION.—Dose of the *powder* ℥j to ʒij; of the *decoction* (prepared by boiling ʒss of the root in Oj of water) fʒj to fʒij.

TRIBE IV. SENECTIONIDÆ.

Style cylindrical; its arms linear, fringed at the point, generally truncate, but sometimes extended beyond the fringe into a line or appendage of some sort.

214. ANTHEMIS NOBILIS, Linn.—COMMON CHAMOMILE.

Sez. Syst. Syngenesia, Polygamia superflua.

(Flores simplices, *L.*—Flowers, *E.*—Flores, *D.*)

HISTORY.—Sibthorp⁵ considers the ἀνθεμὶς of Dioscorides⁶ to be *Anthemis Chia*; but Fraas⁷ is of opinion that it is the *Matricaria Chamomilla*, Linn. Tragus considered the *Anthemis nobilis* to be the παργύριον of Dioscorides, and first gave it the name of *Chamomilla nobilis*. Camerarius distinguished it as the *Roman chamomile*.

¹ Gmelin. *Handb. de Chem.* ii. p. 1288.

² *Berl. Jahrb. d. Pharm.* 1818, p. 251.

³ *Prodr. Fl. Græca*, vol. ii. p. 189.

⁴ *Synopsis Plant. II. Classicæ*, p. 214, 1815.

⁵ Trommsdorff's *Journal*, xviii. 1. 74.

⁶ *Pharmaceutisches Central-Blatt für 1810*, p. 309.

⁷ *Lab. in. cap.* 151.

BOTANY. Gen. Char.—*Head* many-flowered, heterogamous; *florets* of the ray female, in one row, ligulate (rarely none, or somewhat tubular); of the disk, hermaphrodite, tubular, 5-toothed. *Receptacle* convex, oblong, or conical; covered with membranous paleæ between the flowers. *Involucre* imbricated, in a few rows. Arms of the *style* without appendages at the apex. *Achene* tapering or obtusely 4-cornered, striated or smooth. *Pappus* either wanting, or a very short, entire, or halved membrane; sometimes auriculate at the inside. (*De Cand.*)

Sp. Char.—*Stem* erect, simple, ramose, downy-villose. *Leaves* downy, sessile, pinnatisect; segments split into many linear-setaceous lobes. *Branches* flowery, naked, 1-headed at the apex. Scales of the *involucre* obtuse, hyaline at the margin. Paleæ of the *receptacle* lanceolate, pointless, somewhat shorter than the floret, slightly eroded at the margin. (*De Cand.*)

Roots shiny, with long fibres. *Stems* in a wild state prostrate, in gardens more upright, a span long, hollow, round. *Flowers* of the disk yellow; of the ray, white. *Receptacle* convex.

Anthemis nobilis flore pleno, *De Cand.*; *Double Chamomile*.—In this variety, the yellow tubular hermaphrodite florets of the disk are entirely or partially converted into white ligulate female florets.

Sir J. Smith¹ speaks of the *discoïd variety*, destitute of rays, as being more rare. It ought perhaps, he adds, to be preferred for medicinal use.

Hab.—Indigenous; on open gravelly pastures or commons. Perennial. Flowers from June to September. Cultivated at Mitcham and in Derbyshire, for the London market.²

DESCRIPTION.—The floral heads (*flores chamæmeli romani seu anthemidis nobilis*) have a strong and peculiar odour, and a bitter aromatic taste. When fresh, they exhibit a strong and peculiar fragrantcy when rubbed. They should be dried in the shade.

Two kinds of chamomiles are distinguished in the shops—the one called *single*, the other *double*; both sorts are cultivated at Mitcham.

1. *Single Chamomile Flowers* (*flores anthemidis simplices*).—These are sold at Apothecaries' Hall, London. Strictly speaking, *single* chamomiles are those which have one row only of white female ligulate florets; but few flowers are in this condition; in most of the so-called single flowers, some of the yellow tubular florets have become converted into white ligulate florets. It is obvious, therefore, that the distinction between the so-called single and double flowers is to a certain extent arbitrary. Single chamomiles are usually preferred, on account of their having the largest yellow disks, in which the oil chiefly resides. They are, therefore, more powerfully odoriferous.

2. *Double Chamomile Flowers* (*flores anthemidis pleni; chamæmelum flore pleno*, Lewis; *chamæmelum flore multiplici*, C. Bauhin.)—These constitute the sort usually found in the shops. In these, all or most of the yellow tubular florets have become converted into the white ligulate ones. The flowers are consequently whiter, larger, and more showy, though rather less odoriferous, and contain less volatile oil.

At Mitcham, a variety called the *new sort* of chamomile is cultivated, which yields by distillation a blue volatile oil.

The *Flores Chamomillæ* of German pharmacologists are the produce of *Matricaria Chamomilla*, Linn., or *Common Wild Chamomile*. They yield by distillation a blue volatile oil.

The *Flores Chamomillæ fatidæ* are the produce of *Marula Cotula*, *De Cand.* (*Anthemis Cotula*, Linn.)

COMPOSITION.—In 1833, chamomile flowers were analyzed by J. P. Wysz,³ who gives the following as their constituents: *Fat*, *chlorophyll*, traces of *tannic acid*, and *volatile oil* 3.625, *wax* 1.5, *bitter matter* extracted by ether, with traces of *malate of lime* 4.000, *resin* 5.250, *extractive matter* taken up by alcohol, and *malate of lime* 3.125, *albumen* 1.500, *sulphate and tartrate of potash* with *chloride of*

¹ Eng. Fl. vol. iii. p. 457.

² Buchner's Repertorium, Bd. xlvii. S. 19, 1933.

³ Pharmaceutical Journal, vol. x. p. 116, 1850.

potassium and malate of lime 1.875, *gum* 0.750, *extractive matter* taken up by water 5.500, *extractive matter* with *phosphate of lime* taken up by hydrochloric acid 7.750, *water* and *loss* 3.125, *fibrous matter* and *loss* 62.000=100.000.

1. **VOLATILE OIL** (see below).

2. **BITTER EXTRACTIVE**.—The bitter principle of chamomiles is soluble in both water and alcohol.

3. **TANNIC ACID**.—The cold watery infusion of the flowers is darkened by sesquichloride of iron, and forms a precipitate with gelatin.

Freudenthal¹ analyzed the dried flowers of the *Common Wild Chamomile* (*Matricaria Chamomilla*), and found them to consist of *volatile oil* 0.28, *resin* 7.89, *bitter extractive* 8.57, *gum* 7.39, *bitartrate of potash* 5.31, *phosphate of lime* 0.97, *woody fibre*, *soluble albumen*, *water*, and *loss* 69.6. These flowers were also analyzed by Herberger and Damur.²

PHYSIOLOGICAL EFFECTS.—Chamomiles produce the effects of the *aromatic bitter tonics* before alluded to (see *ante*, p. 244); their aromatic qualities depend on the volatile oil, their stomachic and tonic qualities on bitter extractive and tannic acid. In large doses they act as an emetic.

USES.—Chamomiles are an exceedingly useful stomachic and tonic in *dyspepsia*, with a languid and enfeebled state of stomach, and general debility. As a remedy for *intermittents*, though they have gained considerable celebrity, they are inferior to many other medicines. The oil is sometimes used to relieve *flatulency*, *griping*, and *eructation*; and the warm infusion is employed as an *emetic*.

ADMINISTRATION.—The *powder* is rarely employed, on account of the inconvenient bulk of the requisite quantity, and its tendency to excite nausea.—Dose, grs. x to ʒss or more. The *infusion* is the more elegant preparation; this, as well as the *extract* and *oil*, are officinal. *Fomentations of Chamomile flowers* consist of the infusion or decoction, and are used quite hot; but they present no advantage over water of the same temperature. *Flannel bags filled with chamomiles and soaked in hot water* are useful topical agents for the application of moist warmth, on account of their retention of heat.

1. **INFUSUM ANTHEMIDIS**, L. E. D. [U. S.]; *Infusum Chamæmeli*; *Infusion of Chamomile*; *Chamomile Tea*.—(Chamomile ʒv [ʒss, U. S.]; Boiling [distilled, L.] Water Oj, L. E.—Chamomile Flowers, dried, ʒss; Boiling Water ʒxij, D. Macerate for ten [twenty, E., fifteen, D.] minutes.)—It is taken warm, to excite gentle vomiting, or to promote the operation of an emetic. The cold infusion is usefully employed as a domestic stomachic bitter and tonic in dyspepsia. Dose of the cold infusion fʒj to fʒij; of the warm infusion *ad libitum*.

2. **EXTRACTUM ANTHEMIDIS**, E.; *Extractum Chamæmeli*; *Extract of Chamomile*.—(Chamomile lbj; boil it with a gallon of water down to four pints; filter the liquid hot; evaporate in the vapour-bath to a due consistence, E.)—One hundred weight of the flowers yield about forty-eight pounds of extract. The volatile oil is dissipated during the preparation. The extract is a bitter stomachic and tonic. It is generally used as a vehicle for the exhibition of other tonics, in the form of pills. Conjoined with the oil of chamomile, we can obtain from it all the effects of the recent flowers.—Dose, grs. x to ʒj.

3. **OLEUM ANTHEMIDIS**, L. E. D.; *Oleum Chamæmeli Romani*; *Oleum Chamæmeli*; *Oil of Chamomile*; *Oil of the Roman Chamomile*.—(Obtained by submitting the flowers to distillation with water.)—One hundred weight of flowers yields from ʒiiss to ʒij of oil. The oil of the shops is frequently brought from abroad, and is probably the produce of another plant (*Matricaria Chamomilla*); hence, the London College directs the English oil (*oleum anthemidis anglicum*) to be kept. The oil of chamomile, which, when first drawn, is pale blue, becomes, by exposure to light and air, yellow or brownish. Lewis³ says that the yellow oil, with a cast of greenish or brown, has a sp. gr. of 0.9083. When fresh, its odour is strong

¹ Gmelin, *Handb. de Chem.* ii. 1292.

² *Mat. Med.*

³ Buchner's *Repertorium*, Bd. xlv. S. 361, 1833.

and peculiar, and its taste pungent and nauseous. It is stimulant and antispasmodic. It is a frequent addition to tonic and cathartic pills; it communicates stimulant qualities to the former, and is believed to check the griping caused by the latter. It is occasionally exhibited in the form of elæosaccharum. Dose, $\mathfrak{m}\text{j}$ to $\mathfrak{m}\text{v}$.

215. ANACYCLUS PYRETHRUM, *De Cand.*—PELLITORY OF SPAIN.

Anthemis Pyrethrum, Linn.

(*Radix*, L.—*Root*, E.)

HISTORY.—Dioscorides¹ was acquainted with *πίρεθρον*, and speaks of its use in toothache. The word *pyrethrum* is mentioned once only by Pliny.²

BOTANY. **Gen. Char.**—*Head* many-flowered, heterogamous. *Florets* of the ray female, sterile, ligulate or somewhat so, very rarely tubular; of the disk hermaphrodite, with 5 callous teeth. *Receptacle* conical or convex, paleaceous. *Involucre* in few rows, somewhat campanulate, shorter than the disk. All the *corollas* with an obcompressed, 2-winged, exappendiculate tube. *Style* of the disk, with exappendiculate branches. *Achene* flat, obcompressed, bordered with broad, entire wings. *Pappus* short, irregular, tooth-letted, somewhat continuous with the wings on the inner side. (*De Cand.*)

Sp. Char.—*Stems* several, procumbent, somewhat branched, pubescent. *Radical leaves* expanded, petiolated, smoothish, pinnatisect; the segments pinnatipartite, with linear subulate lobes; the cauline leaves sessile. *Branches* 1-headed. *Involucral* scales lanceolate, acuminate, brown at the margin. *Receptacle* convex, with oblong-obovate, obtuse paleæ. (*De Cand.*)

Root fusiform, fleshy, very pungent, and, when fresh, producing a sensation of extreme cold, followed by heat when handled. *Florets* of the ray white on the upper side, purplish beneath; of the disk, yellow.

Hab.—Barbary, Arabia, Syria, and perhaps Candia.

DESCRIPTION.—The root (*radix pyrethri*; *r. pyrethri romani veri*) is imported from the Levant packed in bales. It consists of inodorous pieces, about the length and thickness of the little finger, covered with a thick brown bark, studded with black shining points, breaking with a resinous fracture, and presenting internally a radiated structure. When chewed, it excites a pricking sensation in the lips and tongue, and a glowing heat.

German pellitory root (*radix pyrethri communis seu germanici*) is in much thinner, somewhat longer pieces, crowned superiorly with the bases of the stalks and petioles. It is the produce of *Anacyclus officinarum* of Hayne,³ which Nees⁴ regards as a variety of *A. Pyrethrum* of Schrader. *De Candolle*⁵ considers it to be identical with *A. pulcher* of Besser.

COMPOSITION.—It was analyzed by John,⁶ by Gautier,⁷ by Parisel,⁸ and lastly by Koene.⁹ Parisel obtained *acid matter* (*pyrethrin*) 3, *inulin* 25, *gum* 11, *tannin* 0.55, *colouring matter* 12, *lignin* 45, *chloride of potassium* 0.79, *silica* 0.85, and *iron* a trace.

PYRETHRIN; Acid Principle; Resin.—In this resides the activity of the root. It exists in greater abundance in the bark than in the wood. It is brown, soft, has a burning acid taste, is insoluble in water, but soluble in ether and alcohol; still more so in acetic acid and the oils (volatile and fixed). Koene says, pyrethrin consists of three substances:—

a. A brown acid resin, soluble in alcohol, insoluble in water or caustic potash.

β. An acid brown fixed oil, soluble in potash.

γ. A yellow acid oil, soluble in potash.

PHYSIOLOGICAL EFFECTS.—Pellitory is an energetic local irritant. Applied to the skin, it acts as a rubefacient.

¹ Lib. iii. cap. 66.

² Darst. u. Besch. d. in d. Arzneykunde gebr. Gewächse, Bd. vi. Tab. 46.

³ Geiger's Pharmacie, 2te Aufl. 1839.

⁴ Gmelin, Handb. d. Chem. ii. 1292.

⁵ Ann. de Chim. Phys. lxx. 327.

⁶ Hist. Nat. lib. xxviii. cap. 42, ed. Valp.

⁷ Ibid. vi. Tab. 46.

⁸ Prodromus, t. vi. p. 16.

⁹ Journ. de Pharm. iv. 49.

¹⁰ Ibid. xix. 251.

USES.—Scarcely ever employed internally. Its principal use is to yield a tincture for the relief of toothache. As a masticatory and sialogogue, it is chewed in some rheumatic and neuralgic affections of the head and face, and in palsy of the tongue. In relaxation of the uvula, it is occasionally employed in the form of gargle. It was formerly employed internally as a gastric stimulant.

ADMINISTRATION.—Dose, as a masticatory, ʒss to ʒj. *Tinctura pyrethri* (composed of Pyrethrum, Water, of each one part; Rectified Spirit, five parts) is used to relieve toothache.

216. ARTEMISIA ABSINTHIUM, Linn.—COMMON WORMWOOD.

Sex. Syst. Syngenesia, Polygamia superflua.

(*Herba florens*, L.—*Herb*, E.)

HISTORY.—In all probability this plant is the *ἀλθύιον* of Hippocrates¹ and Dioscorides.² The term *wormwood* occurs several times in our translation of the Old Testament;³ but the plant meant would appear to be both bitter and poisonous.

BOTANY. Gen. Char.—*Heads* discoidal, homogamous or heterogamous. *Florets* of the ray in one row, usually female and 3-toothed, with a long bifid protruding style; of the disk, 5-toothed, hermaphrodite, or, by the absorption of the ovary, sterile or male. *Involucral* scales imbricated, dry, scarious at the edge. *Receptacle* without paleæ, flattish or convex, naked or fringed with hairs. *Achene* obovate, bald, with a minute epigynous disk. (De Cand.)

Sp. Char.—An erect undershrub. *Leaves* silky, hoary, tripinnatisect; the segments lanceolate, somewhat dentate, obtuse. The *heads* small, racemose-paniculate, globose, nodding. Exterior scales of the *involucre* somewhat silky, linear, lax; interior ones rounded, scarious, somewhat naked. (De Cand.)

Herb covered with silky hoariness, intensely bitter, with a strong peculiar odour. *Stems* numerous, about a foot high. *Leaves* rather greener on the upper side; lower ones on long footstalks; upper on shorter, broader, somewhat winged ones. *Florets* pale yellow, or buff.

Hab.—Indigenous; in waste grounds. Perennial. Flowers in August.

DESCRIPTION.—The dried herb with the flowers, or the tops (*herba seu summitates absinthii*), have a whitish-gray appearance, a soft feel, a strong aromatic and somewhat unpleasant odour, and an extremely bitter aromatic taste. The cold watery infusion becomes grayish, olive-green, and turbid (*tannate of iron*) on the addition of sesquichloride of iron.

COMPOSITION.—This plant has been analyzed by Kunsemuller,⁴ by Braconnot,⁵ and by Haynes.⁶ The extract was examined by Leonardi.⁷ Braconnot found volatile oil 0.15, green resin 0.50, bitter resin 0.233, albumen 1.250, starch 0.133, azotized matter having little taste 1.333, bitter azotized matter 3.0, woody fibre 10.833, absinthate of potash 0.917, nitrate of potash 0.333, sulphate of potash and chloride of potassium, traces, water 81.2.

1. **VOLATILE OIL** (*Oleum Absinthii*).—Green, sometimes yellow or brownish oil, having a strong odour of wormwood, and an acrid, bitter, peculiar taste. Its sp. gr. is 0.972. Nitric acid colours it green, then blue, afterwards brown.

2. **BITTER PRINCIPLE** (*Absinthin*).—Caventou⁸ obtained what he calls the pure bitter principle by precipitating an infusion of wormwood by acetate of lead, and separating the excess of lead by sulphuretted hydrogen. The liquor was then evaporated to dryness, and the extract digested in alcohol mixed with ether; and the solution abandoned to spontaneous evaporation. The product was a very bitter matter, in brown ramifications. By heat, no crystalline sublimate could be obtained.

¹ *Opera*, pp. 491, 587, &c. ed. Fœs.

² *Dent.* xxix. 1; *Prop.* v. 4.

³ *Bull. de Pharm.* v. 549.

⁴ *Journ. de Pharm.* xiv. 620.

⁵ *Lib. iii. cap.* 26.

⁶ *Phil. Nat. Med.* iv. 331.

⁷ *Geiger, Handb. d. Pharm.* ii. 1509.

⁸ *Journ. de Chim. Méd.* t. iv. p. 550.

3. **ABSINTHIC ACID.**—May be precipitated, according to Braconnot, from the watery infusion of wormwood by acetate of lead. It is very acid, uncrystallizable, and deliquescent. It does not precipitate the solutions of the nitrates of lead, mercury, and silver; but causes flocculent precipitates when dropped into barytes or lime-water. *Absinthate of ammonia* crystallizes in quadrilateral prisms insoluble in alcohol.

4. **SALT OF WORMWOOD** (*Sal Absinthii*).—This is impure carbonate of potash, obtained by incinerating wormwood.

PHYSIOLOGICAL EFFECTS.—In moderate doses it produces the ordinary effects of the aromatic bitter tonics (see ante, p. 244). Its bitter principle becomes absorbed: hence, the flesh and milk of animals fed with it are rendered bitter. Borrich¹ says that the milk rendered bitter by it proves noxious to the infant.

Large doses irritate the stomach and excite the vascular system. A specific influence over the nervous system, characterized by headache, giddiness, &c., has been ascribed to it.² This has usually been supposed to depend on the volatile oil; but a similar power has been assigned to the bitter principle.

USES.—Wormwood is but little employed in medicine. It is adapted for dyspepsia occurring in debilitated and torpid constitutions. It was at one time celebrated for the cure of intermittents; but it has been superseded by other and more powerful febrifuges. It is said to be efficacious as an anthelmintic, but is very rarely employed as such.

ADMINISTRATION.—Dose of the powder, ℥j to ʒj; of the infusion (prepared by macerating ʒj of the dried herb in Oj of boiling water), fʒj to fʒij.

Artemisia vulgaris, or Mugwort, has been employed in epilepsy, infantile convulsions, chorea, hysteria, and amenorrhœa. But I suspect its powers are feebler than the preceding species.

217. *Artemisia Moxa*, De Cand.—Moxa-Weed.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia; Moxa.)

The *moxa* is a small mass (usually cylindrical or pyramidal) of combustible vegetable matter, employed for effecting cauterization (*moxybustion* of Percy).³ It has long been known that the Chinese and Japanese prepared it from a species of *Artemisia*,⁴ which Dr. Lindley⁵ says is the *A. Moxa*, De Cand.; and Dr. Roxburgh⁶ observes, that the *A. indica* has none of the soft white down on the under side of its leaves, of which *moxa* is made in Japan and China.

The Chinese and Japanese *moxa* is said by some to be prepared from the cottony or woolly covering of the leaves of the *Artemisia*. Thunberg,⁷ however, states that in Japan the dried tops and leaves are beat till they become like tow; this substance is then rubbed betwixt the hands till the harder fibres and membranes are separated, and there remains nothing but a fine cotton.

European *moxas* are usually made either with cotton-wool (which has been soaked in a solution of nitrate or chlorate of potash) or the pith of the sun-flower (*Helianthus annuus*), which contains naturally nitrate of potash. Their shape is either cylindrical or conical; their size is variable. Percy's *moxas*, prepared by Robinet, are usually found in the London shops. They consist of pith rolled in cotton and enveloped in muslin.

The physiological effects of the *moxa* are twofold, *primary* and *secondary*. It first excites an agreeable sensation of heat. This is speedily followed by pain, which progressively increases until it becomes most severe, and the vitality of the part is destroyed. The parts immediately around the eschar are intensely red. The eschar may be deep or superficial, according to the time the *moxa* is kept in contact with the skin. The action of the *moxa* differs from that of the metallic actual cautery in this important particular, that the heat acts slowly, increases gradually, and penetrates to a greater depth. The secondary effects consist in the production of inflammation, by which the eschar is separated, and establishment of suppuration more or less profound, according to circumstances.

Moxa is employed in the treatment of diseases, on the principle of counter-irritation, before explained (see vol. i. p. 170). This, indeed, has been denied by those⁸ who consider the production of a discharge as the only mode of effecting counter-irritation. It is adapted for chronic

¹ Act. Hafn. vol. ii. p. 165.

² See Lindestolpe, in Murray, *App. Med.*; and Kraus, *Heilmittell.* p. 422.

³ Diet. Sc. Med. xxxiv. 174.

⁴ Isaacro, *Fl. Cochinchinensis*, ii. 499; Thunberg, *Voyages au Japon*, &c. iv. 74.

⁵ *Fl. Ind.* iii. 420.

⁶ See Boyle, *Treat. on Moxa*, p. 88, 1825.

⁷ *Fl. Med.* 463.

⁸ *Op. cit.*

diseases and maladies characterized by lesions of sensation or motion; and it is, on the other hand, injurious in all acute inflammatory diseases. The following is a list of the principal diseases against which it has been employed; and for farther information respecting them, I must refer the reader to the writings of Larrey,¹ Boyle,² Wallace,³ and Dunglison,⁴ as the limits and objects of this work do not admit of farther details.—1. *Paralysis of the sentient or motor nerves*. Great benefit has been obtained by the use of moxa in this class of diseases. Amaurosis, deafness, loss of voice and speech, hemiplegia, and especially paraplegia, have been relieved by it. 2. *Painful affections of nerves, muscles, or the fibrous tissues*: as neuralgia, sciatica, lumbago, and chronic rheumatism. 3. *Spasmodic diseases*, either of particular parts or of the general system; as spasmodic asthma, epilepsy, &c. 4. *Diseased joints and spinal maladies*: as chronic articular inflammation, white swelling, stiff joints, hip-joint disease, curvature of the spine, &c. 5. *Visceral diseases*; as organic diseases of the brain, phthisis pulmonalis, chronic hepatitis and splenitis, &c.

In the employment of moxa, two points deserve especial attention; first, the parts proper or otherwise for its use; and secondly, the mode of applying it. It has been applied to nearly every part of the body. Larrey, however, considers the following parts improper for its application: 1. All that part of the skull covered by skin and pericranium only. 2. The eyelids, nose, ears, larynx, trachea, sternum, glandular parts of the breasts, linea alba, and parts of generation. 3. Over the course of superficial tendons, articular prominences, where there is danger of injuring the articular capsules, and projecting points of bone.

The mode of applying moxa is as follows: Set it on fire at the summit, and apply its base (by a *porte-moxa*, pair of forceps, wire, or other convenient instrument) to the skin. To prevent the surrounding parts being burnt by sparks, Larrey recommends them to be previously covered with a wet rag, perforated in the centre, to admit the base of the moxa. If the combustion flag, it may be kept up by the breath, blow-pipe, or bellows. After the combustion is over, Larrey recommends the immediate application of liquor ammoniæ, to repress excessive inflammation and suppuration.

218. *Artemisia*. ONE OR MORE SPECIES YIELDING WORMSEED.

The substance sold in the shops under the name of *Wormseed* consists of broken peduncles, mixed with the calyx and flower-buds of some species of *Artemisia*. It has been known by various names; as *semen-contra*, (an abridgment of the Latin phrase "*semen contra vermes*,") *semen santonicum*, *semen cinæ*, *semen sementina*, &c.

The sort usually found in English shops is that brought from the Levant (*semen cinæ levanticum*, *halepense*, vel *alexandrinum*), and which is considered to be the best. By some writers it is said to be the produce of Bucharia, and to come into Europe through Russia; hence it has been called *semen cinæ muscoviticum*. Guibourt⁵ declares it to be the produce of *Artemisia Contra*, Linn. (*A. Sieberi*, Besser.) But three other species, viz.: *A. Vahlana*, *A. pauciflora*, and *A. Lercheana* are also said to supply part of it.⁶ Barbary wormseed (*semen cinæ barbaricum* seu *africanum*) is considered by Guibourt to be the produce of *Artemisia glomerata* of Sieber. It consists of small globular flower-buds attached to the extremity of the branches. A third sort, called Indian or East Indian wormseed (*semen cinæ ostindicum*) has been described. It agrees with the Barbary sort, except in colour, which is more greenish yellow.

Wormseed has been analyzed by Trommsdorff⁷ and by Wackenroder.⁸ The latter found in the Levant wormseed the following ingredients: volatile oil 0.0039, bitter matter 20.25, resinous bitter substance 4.45, green resin 6.05, cerin 0.35, gummy extractive 15.50, album 8.50, malate of lime with a little silica 2.00, woody fibre 35.45, intermixed earthy matter 6.70. More recently, a crystalline substance called *santonine* or *cinin* (C¹⁰H⁶O²) has been obtained from wormseed. It is odourless, bitter, and scarcely soluble in cold water.

Wormseed is employed as a vermifuge in doses of from ʒj to ʒij, repeated night and morning, and succeeded by a brisk purge.⁹

219. *Tanacetum vulgare*, Linn.—Common Tansy.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia.)

Tansy was ordered to be cultivated in gardens by Charlemagne.¹⁰

It is an indigenous plant, which is cultivated in gardens as a medicinal or pot-herb, or for

¹ *Dict. de Scien. Méd.* art. *Moxa*.

² *Physiol. Eng. resp. Moxa*. 1827.

³ *Hist. Nat. des Drogues simpl.* t. iii. p. 37, 4ème éd. 1850.

⁴ Nees, *Geiger's Pharmacæ*, 2te Aufl. 1839.

⁵ Trommsdorff's *Neue Journal*, Bd. iii.

⁶ For farther details respecting the medicinal qualities of this drug, see Woodville's *Méd. Botany*, vol. ii. p. 337.—Woodville's *Artemisia santonica* is the *A. Maritima*, var. *ℒ suaveolens*, of De Candelie.

¹⁰ Sprengel, *Hist. Rei Herb.* i. 220.

⁷ *Op. supra cit.*

⁸ *New Remedies*.

⁹ *Ibid.* Bd. xiv. 1297.

ornament. The herb and flowers (*herba et flores tanacetii*) have a disagreeable aromatic odour and a nauseous, strong, aromatic, bitter taste. The infusion is rendered dark green and turbid (tannate of iron) by sesquichloride of iron. Both leaves and flowers have been analyzed by Fromherz and by Peschier.¹ The constituents of the leaves, according to Peschier, are—*volatile oil, fatty oil, wax or stearine, chlorophylle, bitter resin, yellow colouring matter, tannin with gallic acid, bitter extractive, gum, woody fibre, tanacetie acid*. The *volatile oil (oleum tanacetii)*, is yellow, but sometimes green. It has the peculiar odour of the plant, a warm, bitter taste, and a sp. gr. of 0.952. The *bitter matter* is the substance usually denominated extractive; but according to Peschier, it is in part resin. *Tanacetie acid* is crystallizable, and precipitates lime, baryta, and oxide of lead, and causes a precipitate with a solution of acetate of copper.

Tansy produces the usual effects of the *aromatic bitter tonics* (see *ante*, p. 244). "A fatal case of poisoning with half an ounce of oil of tansy is recorded in the *Medical Magazine*, Nov. 1834. Frequent and violent clonic spasms were experienced, with much disturbance of respiration; and the action of the heart gradually became weaker till death took place from its entire suspension. No inflammation of the stomach or bowels was discovered upon dissection."² The young leaves are occasionally employed by the cook to give colour and flavour to puddings, and in omelets and other cakes. In medicine, the plant is rarely employed by the regular practitioner; but it has been recommended in dyspepsia, intermittents, and gout.³ Its principal use, however, is as a vermifuge. *Tansy tea* (prepared by infusing ℥ij of the herb in Oj of boiling water) may be taken in doses of from ℥j to ℥iij. A drop or two of the oil may be added to vermifuge powders and pills. The seeds have been used instead of *semina santonica*.

220. ARNICA MONTANA, Linn.—MOUNTAIN ARNICA.

Sex. Syst. Syngenesia, Polygamia superflua.

(Flores, Folia, et Radix.)

HISTORY.—This plant does not appear to have been known to the ancients; at least no undoubted mention of it occurs in their writings.

BOTANY. Gen. Char.—*Head* many-flowered, heterogamous. *Florets* of the ray in one row, female, ligulate; of the disk, hermaphrodite, tubular, 5-toothed. *Involucre* campanulate, in 2 rows, with linear-lanceolate equal scales. *Receptacle* fringed, hairy. *Tube of the corolla* shaggy. Rudiments of sterile *stamens* sometimes remaining in the ligulæ. *Style* of the disk with long arms, covered by down running a long way down, and truncated or terminated by a short cone. *Achene* somewhat cylindrical, tapering to each end, somewhat ribbed and hairy. *Pappus* in 1 row, composed of close, rigid, rough hairs. (De Cand.)

Sp. Char.—*Radical leaves* obovate, entire, 5-nerved; the cauline ones in 1 or 2 pairs. *Stem* 1- to 3-headed. *Involucres* rough with glands. (De Cand.)

Perennial. Stem hairy, about 1 foot high. *Florets* yellow, tinged with brown.

Hab.—Meadows of the cooler parts of Europe, from the sea-shore to the limits of eternal snow.

DESCRIPTION.—The root (*radix arnicæ*) consists of a cylindrical caudex, from 2 to 3 inches long, and 2 or 3 lines thick, from which many fibres arise. It is brown externally, has a disagreeable yet aromatic odour, and an acrid nauseous taste. The dried flowers (*flores arnicæ*) are yellowish, and have a similar taste and smell to the root. The leaves (*folia arnicæ*) have a like smell.

COMPOSITION.—Pfaff⁴ found in the root *volatile oil* 1.5, *acid resin* 5.0, *extractive* 32.0, *gum* 9.0, and *woody fibre* 5.5. The root has also been examined by Weissenburger.⁵ Chevallier and Lassaigne⁶ analyzed the flowers, and found in them *resin, bitter acrid matter (cyttisin), yellow colouring matter, gum, albumen, and gallic acid*. In the ashes were salts of potash, and lime, and silica. Mr. Bastick⁷ has announced the existence of an alkaloid, which he calls *arnicina*, in the flowers.

1. **VOLATILE OIL.**—The oil obtained from the root (*oleum radicis arnicæ*, Cod. Hamburg) is yellowish, lighter than water (sp. gr. 0.94), and has a burning aromatic taste. Sixteen pounds of the dried root yield about an ounce of oil. The volatile oil of the flowers is blue.

¹ Gmelin, *Hand. d. Chem.* ii. 1290.

² *United States Disp.* from the *Am. Journ. of the Med. Sciences*, xvi. 256.

³ *Cullen. Mat. Med.* ii.

⁴ Gmelin and Kunze, *Pharm. Waarenk.* Bd. ii. S. 177.

⁵ *Pharmaceutical Journal*, vol. x. p. 386, 1851.

⁶ *Mat. Med.* Bd. iii. S. 210.

⁷ *Journ. de Pharm.* t. v. p. 248.

2. **RESIN (Arnica).**—The acidity of the root and flowers resides, according to Pfaff, in the resin, which is soluble in alcohol.

3. **EXTRACTIVE MATTER.**—According to Chevallier and Lassaigne, this is nauseous, acrid, bitter, and soluble in both water and spirit. They consider it to be analogous to *cytisin*.

4. **ARNICINA.**—Not volatile, bitter but not acrid, slightly soluble in water but more so in alcohol and ether. Its hydrochlorate is crystallizable (Bastick).

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—The effects of the flowers of *Arnica* on horses have been examined by Viborg.¹ An infusion of six drachms of the flowers quickened the pulse, and acted as a diuretic. An infusion, thrown into the veins, caused insensibility.

β. On Man.—Jörg and his pupils have submitted themselves to the influence of this plant.² From their observations, as well as from the testimony of others, *Arnica* appears to possess acrid properties. When swallowed, it causes burning in the throat, nausea, vomiting, gastric pains, and loss of appetite. The active principle becomes absorbed, quickens the pulse and respiration, and promotes diaphoresis and diuresis. Farthermore, it appears to exert a specific influence over the nervous system, causing headache, giddiness, and disturbed sleep. Sundelin³ considers it to be closely allied in operation to *senega*, from which, he says, it differs in its stimulating influence over the nervous system, and in its causing constipation.

USE.—*Arnica* is indicated in diseases characterized by debility, torpor, and inactivity. It is administered as a stimulant to the general system in various debilitated conditions, and in typhoid fevers; to the nervous system in deficient sensibility, as amaurosis; to the muscular system in paralysis; to the vascular system and secreting organs when the action of these is languid, and requires to have its energy increased, as in some forms of dropsy, chlorosis, amenorrhœa, asthenic inflammation, &c. Farthermore, it has been employed empirically in some maladies, as diarrhœa, dysentery, &c. It is rarely employed in this country.

ADMINISTRATION.—1. *Of the flowers.* Dose of the *powder*, grs. v to grs. x mixed with syrup or honey to form an electuary. The *infusion* and *tincture* are more convenient preparations. *Infusum arnicæ (florum)*, Ph. Castr. Ruth., is made with ℥ss of the flowers to ℔j of water; dose, f℥j to f℥ij. *Tinctura arnicæ (florum)*, Ph. Boruss., is prepared with ℥iss of the flowers to ℔j of rectified spirit; dose, f℥ss to f℥iss. —2. *Of the root.* This may be given in the form of infusion. *Infusum arnicæ (radicis)*, Ph. Castr. Ruth., is made with ℥ij of the root to ℔j of water; dose, f℥j.

221. LACTUCA SATIVA, De Cand.—THE GARDEN OR COS LETTUCE.

Lactuca sativa, var. *a*, Linn.

Sex. Syst. Syngenesia, Polygamia æqualis

(Herba florens, *L.*—Inspissated juice. *E.*—Inspissated juice and leaves, *D.*)

HISTORY.—The *σπίδαξ*, or *Lettuce*, was well known to the ancient Greeks and Romans. It is mentioned by Hippocrates⁴ both as an aliment and medicine; and by Dioscorides.⁶ It is probable that the *σπίδαξ ἡμερος* of the latter writer is our *Lactuca sativa*.⁷ “The sedative powers of *Lactuca sativa*, or Lettuce, were known,” observes Dr. Paris,⁷ “in the earliest times; among the fables of antiquity, we read that, after the death of Adonis, Venus threw herself on a bed of lettuces to lull her grief and repress her desires.”

BOTANY. Gen. Char.—*Heads* many or few-flowered. *Involucre* cylindrical, calyculate-imbricate, in 2 or 4 rows; outer rows short. *Receptacle* naked. *Achenes* plane, obcompressed, wingless, abruptly terminating in a filiform beak. (De Cand.)

¹ *Wirk. d. Arzneim. u. Gifte*, i. 231.

² *Ibid.* S. 226.

³ *Hand. d. sp. Heim.* ii. 170, 3tte Aufl.

⁴ *De Diata*, ii. p. 359; and *De Morb. Mul.* i. 629 and 635.

⁵ *Lib.* ii. cap. 165.

⁶ This also is the opinion of Fraus (*Synops. Plant. Fl. Classica*, p. 199, 1845).

⁷ *Pharmacol.* vol. i. p. 13, 6th ed.

Sp. Char.—*Leaves* not concave, erect, oblong, narrowed at the base, smooth at the keel. *Stem* elongated, leafy. (De Cand.)

Annual. *Stem* erect, simple below, branched above, 1 or 2 feet high, smooth. *Leaves* rounded or ovate, semi-amplexicaul, frequently wrinkled, usually pale green; varying much in the different varieties. *Flowers* yellow.

Hab.—Native country unknown; perhaps the East Indies. Extensively cultivated in Europe under the name of the *Cos Lettuce* (*Laitue romaine*, *Lactuca romana*).

LACTUCA CAPITATA, De Cand., or *Cabbage Lettuce*, and *L. CRISPA*, De Cand., or *Curled Lettuce*, were considered by Linnæus to be varieties of *L. sativa*.

DESCRIPTION.—1. *Lettuce leaves* (*folia lactucæ*) are exclusively used as a salad. They are gathered early, before the flower-stem shoots up, and then contain a cooling, bland, pellucid, watery juice. 2. The *flowering plant* (*herba florens*, L.) contains an intensely bitter, milky, slightly narcotic juice, having an odour allied to that of opium. This juice resides in the root, cortical portion of the stem and branches, and in the involucre. 3. *Lactucarium*, or *Lettuce Opium*, is the inspissated milky juice (see p. 600).

COMPOSITION.—In the young state in which the plant is usually brought to table, its juice consists chiefly of *water*, *mucilage*, *albumen*, and *saccharine matter*. But in the flowering state the juice also contains *resin*, a *peculiar waxy substance* (lactucerin), and a *crystalline bitter substance* (lactucin). Pagenstecher¹ obtained from the distilled water of lettuce an odorous sulphurated *volatile oil*. (See also the composition of *Lactucarium* from *Lactuca sativa*, p. 600).

The decoction of the flowering herb is rendered dark green and turbid by the salts of the sesquioxide of iron.

PHYSIOLOGICAL EFFECTS.—The early leaves of the lettuce, eaten as a salad, are easily digested, but they yield only a small portion of nutritive matter. They probably possess, in a very mild degree, soporific properties. The ancients considered them anti-aphrodisiac. The flowering plant is more powerful, and produces, in a feeble degree, the effects of lactucarium (see p. 601).

USES.—Lettuce leaves are employed at the table as a salad. As they appear to possess slight hypnotic properties, they may be taken with advantage at supper, to promote sleep. Galen,² who in his old age was troubled with watchfulness, was relieved by the use of lettuce at night. On the other hand, prudence points out the propriety of abstaining from the use of this plant if there be any tendency to apoplexy.

EXTRACTUM LACTUCÆ, French Codex; *Thridace* vel *Thridacium*.—This is sometimes called *French Lactucarium* (*Lactucarium gallicum*). It is an extract obtained by evaporating the juice expressed from the stalks of the lettuce at the flowering season. This extract has not been analyzed. Its composition must resemble that of the juice above noticed. Meissner detected a trace of copper in one specimen. In its effects and uses it resembles, but is much inferior to, Lactucarium. Ganzel³ found that 10 grains of the extract of lettuce introduced into the cellular tissue of the thigh of a small dog killed the animal in three days.

222. LACTUCA VIROSA, Linn.—STRONG-SCENTED LETTUCE.

Sex. Syst. Syngenesia, Polygamia æqualis.

(The inspissated juice, *E.*—Leaves; Inspissated juice, *D*)

HISTORY.—According to Sprengel⁴ and Fraas,⁵ this is the *σπίδαξ ἄγρια* of Dioscorides;⁶ but Dr. Sibthorp⁷ suggests that *Lactuca Scariola* was the plant referred to by Dioscorides.

BOTANY. **Gen. Char.**—See *Lactuca sativa*.

¹ Buchner's *Repertorium*, 2te Reihe, Bd. xxiii. S. 17, 1840.

² Quoted by Buchner, *Repert.* Bd. xlii. 2te Reihe, 1847.

³ *Synops. Plant. Fl. Class.* 1845.

⁴ *Prodr. Fl. Græc.* ii. 126.

⁵ *De aliment. facult.* lib. ii. cap. 40.

⁶ *Hist. Rei Herb.* i. 185.

⁷ Lib. ii. 166.

Sp. Char.—*Stem* erect, round; the base smooth or prickly-setose; the apex panicled. *Leaves* horizontal, prickly-setose at the keel, acutely denticulate, obtuse, at the base arrow-shaped; the lower ones sinuate. *Achenes* striated, usually shorter than the beak. (De Cand.)

Herb abounding in fetid milky juice. *Root* tap-shaped. *Stem* 2 to 4 feet high. *Leaves* distant. *Florets* yellow.

Hab.—Indigenous; about hedges, old walls, and borders of fields; not uncommon. **Biennial.** Flowers in August and September.

LACTUCA VIROSA, var. β **MACULATA**, De Cand.—This variety is distinguished by the purplish-red stems, and the blood-red or purplish-red spots on the obovate radical leaves.

DESCRIPTION.—1. *The leaves of the strong-scented lettuce (folia lactuæ virosæ)*, and other parts of the plant, contain, during the flowering season, a milky juice which has a strong opiate-like odour and bitter taste. The leaves of this species, as well as of *L. Scariola*, are distinguished from those of *L. sativa* by the prickles on the keel of the leaves. 2. *Lactucarium* is obtained from *L. virosa* as well as from *L. sativa* (see p. 599).

COMPOSITION.—The fresh milky juice¹ reddens litmus paper, and is coagulated both by acids and alcohol. It contains *lactucin*, *odorous matter* (volatile oil?), *extractive matter*, *lactucerin*, *albumen*, *resin*, and some *salts* (viz. a vegetable salt of potash, nitrate and sulphate of potash, chloride of potassium, sal ammoniac, and some calcareous and magnesian salts). By exposure to the air it becomes first yellow and afterwards brown, and gradually solidifies. In this state it constitutes *lactucarium*, the composition of which will be stated hereafter.

PHYSIOLOGICAL EFFECTS.—The experiments of Orfila² on dogs show that this plant possesses narcotic qualities; but its powers are not very great, and have been probably much overrated. A solution of the extract, thrown into the veins, caused heaviness of head, slight drowsiness, feebleness of the hind extremities, difficult and frequent respiration, slight convulsive movements, and death. Glaser³ considers it to possess acrid properties. On Wibmer, two grains of the extract caused sleepiness and headache. Its activity depends chiefly on the lactucin.

USES.—It is employed only to furnish lactucarium.

ANTIDOTES.—In cases of poisoning by *Lactuca virosa*, the treatment should be the same as that for poisoning by opium.

LACTUCARIUM, E. D. [U. S.]—LETTUCE OPIUM.

HISTORY.—This is the inspissated milky juice (obtained by incision of the stem) of *Lactuca sativa* and (chiefly) *L. virosa*.⁴ It was first collected and employed by Dr. J. R. Coxe,⁵ of Philadelphia.

But the term "lactucarium" has also been applied to other preparations of the lettuce. Thus, Dr. Duncan, Sen.,⁶ who first employed the term, used it to indicate the extract obtained by evaporating the tincture made with weak spirit of wine; and in France the term is frequently applied to the extract obtained by evaporating the expressed juice (see *ante*, p. 599).

COLLECTION.—In the young state, the plant abounds in a cooling, bland, slightly bitterish, pellucid, watery juice. At this period, while it consists chiefly of a bunch of succulent leaves, *L. sativa* is employed at table as a very agreeable salad. As the flowering period approaches, the stem shoots up above the early leaves, and the juice of the plant becomes milky and bitter, and acquires a smell allied to that of opium. When incisions are made into the stem, this milky juice exudes, and, by

¹ For a good summary of the known properties of the milky juice, see Buchner, *Repertorium*, Bd. xlviii. 2te Reihe, 1847.

² *Toxicol. Gén.*

³ Wibmer, *Wirk. d. Arzn. u. Gift*. Bd. iii. S. 269.

⁴ Auberger (*Comptes rendus*. xv. 923) states that he obtained the largest quantity of lactucarium from *L. altissima* of Bieberstein—a Caucasian plant.

⁵ *Transactions of the American Philosophical Society*, vol. v. p. 388, 1799.

⁶ *Observations on the Preparation of Soporific Medicines from common Garden Lettuce*, read in the Canadian Horticultural Society, March 6, 1810. *Mém. of the Canadian Hort. Soc.* vol. i. p. 169. —A see, *Observations on the Distinguishing Symptoms of three different Species of Pulmonary Consumption*, p. 159, 1813.

exposure to the air, dries and becomes the brown solid called *lactucarium* or *lettuce-opium*. The incisions are effected either by cutting off the top of the stem and removing a fresh slice as often as the surface ceases to yield juice, or by cutting the sides of the stem. The exuded juice is removed by the finger, or by scraping with a knife, placed in a glass or earthenware vessel, and allowed to dry spontaneously.

By drying in the air, the milky juice of *L. virosa* loses about half its weight of water, and yields from 50 to 55 per cent. of *lactucarium*.¹ According to Mr. Duncan,² after the middle period of inflorescence, although the juice becomes thicker, it contains a less proportion of bitter extract, and, therefore, is less fit for yielding *lactucarium*. The quantities of *lactucarium* obtained by Schültz³ from one plant of the following species were—from *L. sativa* 17 grains, *L. scariola* 23 grains, and *L. virosa* 56 grains.

PROPERTIES.—*Lactucarium* or *lettuce-opium*, as usually found in the shops of this country, is in small lumps, which are seldom larger than a pea or small bean; they are rough and irregular on the surface, sometimes covered with an ash-gray efflorescence, of a brown or reddish-brown colour, friable, with an opiate smell and bitter taste. This sort agrees with that said by Dr. Christison to be the *lactucarium* obtained from *L. virosa* in the neighbourhood of Edinburgh.

Lactucarium from *L. sativa* is said by Dr. Christison to occur in roundish, rather compact masses, weighing several ounces.

Lactucarium prepared by Aubergier, pharmacien at Clermont, for commercial purposes, is in round flat cakes, of from 10 to 30 grammes (=154.3 grs. to 463 grs. troy) each, and is often covered with a whitish efflorescence of mannite.⁴

COMPOSITION.—*Lactucarium* has been the subject of repeated analysis. That obtained from *L. sativa* has been analyzed by Klink,⁵ Schrader,⁶ Peschier,⁷ and Peretti.⁸ Pagenstecher⁹ has also contributed to our knowledge of it. *Lactucarium* from *L. virosa* has been analyzed by Klink,¹⁰ Buchner,¹¹ Schlesinger,¹² Walz,¹³ and Ludwig.¹⁴ Lastly, that from *L. altissima* has been examined by Aubergier.¹⁵

LACTUCARIUM.

FROM LACTUCA SATIVA.	FROM L. VIROSA.
<p><i>Klink's Analysis.</i></p> <p>Bitter extractive 55.0 Wax 10.0 Resin 6.9 Caoutchouc 17.5 Water 15.6</p> <hr/> <p>Lactucarium 105.0</p>	<p><i>Buchner's Analysis.</i></p> <p>Odeorous matter undetermined Lactucin, with colouring matter 18.6 Gummy extractive 14.666 Soft resin, with waxy matter 12.467 Waxy matter (myricin) 35.100 Gluten or albumen 19.100</p> <hr/> <p>Air-dried Lactucarium 99.933</p>
<p>FROM L. ALTISSIMA.</p> <p><i>Aubergier's Analysis.</i></p> <p>A crystallizable bitter substance. Two resins. Wax. Mannite. Pectin. Asparagine. Albumen A crystallizable substance, convertible into humus under the influence of alkalis. Salts.</p>	<p><i>Ludwig's Analysis.</i></p> <p>1. Matters insoluble in water— Lactucerin 42.64 Very fusible wax 3.99 Vegetable fibre 2.00 } 48.63</p> <p>2. Matters soluble in water— Albumen 6.98 Bitter extractive 27.68 Watery extractive insoluble in alcohol 14.96 Lactucerin rendered soluble by other substances 1.75 } 51.37</p> <hr/> <p>100.00</p>

¹ Buchner, *Repertor.* Bd. xliii. S. 21, 1832. ² Christison, *Dispensatory*, 2d ed. p. 588, 1848.
³ Buchner's *Repertor.* Bd. xv. S. 272, 1823; Berlin, *Jahrb.* Bd. xxvi. Pt. 1, S. 227.
⁴ Gaybourn, *Hist. Nat. des Drog. simpl.* t. iii. p. 13, 4ème éd. 1850.
⁵ *Diss. inaug. sistens Lactuce virosae et sativae Analys. Chem.* Kiel, 1820 (Pfaff's *Mat. Med.* Bd. vi. S. 504, 1821).
⁶ Gmelin, *Handb. d. Chemie.* ⁷ Wittstein's *Etym.-chem. Handwörterbuch*, Bd. i. S. 873.
⁸ *Pharm. Central-Blatt* für 1831, S. 467.
⁹ Buchner's *Repertorium*, 2te Reihe, Bd. xxiii. S. 17, 1840. ¹⁰ *Diss. supra cit.*
¹¹ *Repertorium*, Bd. xliii. S. 1, 1832. ¹² *Ibid.* 2te Reihe, Bd. xvii. S. 170, 1839.
¹³ *Ibid.* 2te Reihe, Bd. xxiii. S. 20, 1840; and *Pharm. Central-Blatt* für 1840, S. 39.
¹⁴ *Pharm. Central-Blatt* für 1847, S. 438. ¹⁵ *Comptes rendus*, t. xv. p. 76, 1843.

Buchner more recently has given the following estimate, founded on Ludwig's analysis, of the percentage composition of lactucarium: *Lactucin*, in combination with other substances soluble in water and spirit of wine, 28 (the weight of the *odorous matter*, the *asparamide*, and two imperfectly examined *vegetable acids*, was not determined); *salts*, as constituents of the ashes, and including 1 per cent. of oxalic acid, 7; *mannite*, 2; *albumen*, 7; *insoluble vegetable substances*, 2; *lactucerin* (lactucon), 44; *waxy matter* and *soft resin*, 4; *gummy matter*; *proteins*, which Aubergier found in the lactucarium of *L. sativa*, and which is probably also present in that of *L. virosa*, and *water*, 6.

The active principles appear to be the *lactucin* and *odorous matter*, to which Buchner adds the *salts*. The substances which are insoluble in cold spirit of wine and hot water possess no medicinal power.

1. **ODOROUS MATTER; Volatile Oil.**—This substance resembles in smell the odorous matter of opium. When lactucarium is submitted to distillation with water, the odorous principle distils over. Its nature has not been accurately determined. Both Pagenstecher and Walz have obtained a volatile oil, which the former chemist states contained sulphur. From the experiments of Buchner and Walz, it appears to be a basic substance; but Ludwig declares it to be of an acid nature.

2. **LACTUCIN; Bitter Principle of Lactucarium.**—This is a colourless, odourless, crystallizable, fusible, neutral substance. It requires 60 to 80 parts of water to dissolve it; and is readily soluble in alcohol, but less so in ether. Its watery solution is unaffected by acetate of lead, chloride of iron, and nitrate of silver; but, mixed with soda and nitrate of silver, it reduces the precipitated oxide of silver to the metallic state; and mixed with sulphate of copper and soda, and heated to boiling, it reduces the oxide of copper to the state of protoxide. It was obtained by Ludwig thus: 80 parts of lactucarium were rubbed with 80 parts of cold dilute sulphuric acid for half an hour, and then mixed with 400 parts of rectified spirit. The liquid being filtered, slacked lime was added to it, to precipitate the sulphuric acid, and the solution was then evaporated. The brown viscid extract was digested in water, the solution treated by animal charcoal, and filtered and evaporated so as to yield crystals of lactucin.

3. **LACTUCERIN; Lactucon; Waxy Matter of Lactucarium.**—A neutral crystalline substance insoluble in water, but soluble in alcohol, ether, and the fixed and volatile oils. Its formula is $C_{40}H_{32}O_3$.

The *lactucic acid* of Pfaff is declared by Walz to be oxalic acid.

A strong though unfounded suspicion appears to have been entertained, that *morphia* was contained in lactucarium. But in none of the before-quoted analyses was it to be found; neither was Caventou¹ able to detect an atom of either *morphia* or *narcotin* in lactucarium.

CHARACTERISTICS.—The cold aqueous decoction of lactucarium becomes, on the addition of sesquichloride of iron, olive-brown (*tannate? of iron*). Tincture of nutgalls renders the decoction slightly turbid. Heated with lactucarium, colourless nitric acid acquires an orange-yellow tint, and evolves binoxide of nitrogen. The alcoholic tincture of lactucarium becomes slightly turbid on the addition of water.

PHYSIOLOGICAL EFFECTS.—Lactucarium possesses anodyne and sedative qualities: but its powers have, I suspect, been overrated. Ganzel² states, that ten grains introduced into the cellular tissue of a dog's leg caused deep sopor, with occasional convulsions, but no dilatation of the pupil. Francois,³ who made a considerable number of trials of it, observes that it contains neither a narcotic nor an intoxicating principle; but that it allays pain, diminishes the rapidity of the circulation, and, in consequence, reduces the animal heat, and places the patient in a condition more favourable to sleep. Its *modus operandi* is different from that of opium; for the latter substance accelerates the pulse, and produces either delirium or stupor. It is more allied to hyoscyamus, from which, according to Fisher,⁴ it is distinguished by its power of directly diminishing sensibility, being preceded by irritation of the nervous system. Buchner compares the action of lactucin to that of digitalin, and says it diminishes the force and frequency of the pulse and the animal heat, dilates the pupil, and causes sleep and stupor. A more extended experience of the use of lactucarium, however, is requisite to enable us to form accurate conclusions as to the precise nature and degree of its powers.

¹ Journ. de Chim. Méd. i. 300.

² Arch. Gén. de Méd. Juin, 1825, p. 264.

³ Sundelin, Handb. d. sp. Heilm. Bd. i. S. 459, 3te Aufl.

⁴ Lond. Med. Gaz. xxv. 893.

USES.—It is employed as an anodyne, hypnotic, antispasmodic, and sedative, where opium is considered objectionable, either from peculiarities on the part of the patient or from the nature of the disease. Thus, it may be used where there is morbid excitement of the vascular system, in which condition opium is usually contra-indicated. But though it is free from several of the inconveniences which attend the use of opium, yet it is much less certain in its operation. It may be given with advantage to allay cough in phthisis and other pulmonary affections;¹ to relieve nervous irritation and watchfulness in febrile disorders in which opium is not admissible. Dr. Rothamel² has employed it with success in different kinds of fevers, inflammations, exanthemata, profluviæ, cachexies, and painful and peculiar nervous disorders. Vering³ found it especially useful in spasm of the uterus; and Angelot gave it to repress seminal discharges.

ADMINISTRATION.—The usual dose is from grs. iii to grs. v; but it has been given in larger quantities, as from grs. x to grs. xx.

1. *TINCTURA LACTUCARII*, E.; *Tincture of Lactucarium*.—(Lactucarium, in fine powder, 3iv; Proof Spirit Oij. This tincture is best prepared by percolation, as directed for tincture of myrrh; but may also be prepared by digestion with coarse powder of lactucarium.)—As lactucin (the bitter principle of lactucarium) is soluble in proof spirit, this liquid is a fit menstruum for preparing the tincture.

2. *TROCHISCI LACTUCARII*, E.; *Lozenges of Lactucarium*.—(To be prepared with lactucarium in the same proportion and in the same manner as the Opium Lozenge.)—Each lozenge weighs ten grains, and contains nearly one-sixth of a grain of lactucarium.

TRIBE V. CYNARÆ.

Style thickened upwards, and often fringed at the tumour.

223. *Carthamus tinctorius*, Linn.—Safflower, or Bastard Saffron.

Sex. Syst. Syngenesia, Polygamia æqualis.
(Flosculi.)

κρόκος, Theophrastus, Hist. Plant. lib. vi. cap. 3 and 4; κρίκος, Dioscorid. lib. iv. cap. 190.—A native of the East Indies, where, as well as in many other parts of the world (e. g. Egypt, South of Europe, South America, &c.), it is cultivated for commercial purposes.

The officinal parts are the florets, without the involucre. When dried, they constitute the *safflower*, or *bastard saffron* (*flores carthami*), of the shops. They consist of the red tubular corolla divided superiorly into five segments, and inclosing the sexual organs. They have a faint odour, allied to that of saffron, and a feeble bitterish taste. According to Dufour,⁴ safflower consists of red colouring matter 0.5, yellow colouring matter 2.4, acid yellow colouring matter with sulphates of lime and potash 21.4, extractive with yellow colouring matter, chloride of potassium, and acetate of potash 4.2, resin 0.30, wax 0.9, woody fibre 49.6, albumen 5.5, vegetable remains and sand 4.6, alumina and magnesia 0.5, oxide of iron 0.2, moisture 6.2, loss 0.7.

The yellow colouring matter is of the nature of extractive. Its formula, according to Schlieper,⁵ is $C^{10}H^{10}O^{10}$. It is soluble in water, and is useless for dyeing. The red colouring matter (*carthamin* or *carthamic acid*) is of a resinous nature. Its formula, according to Schlieper, is $C^{14}H^{10}O^7$. It is soluble in alcohol and alkaline liquids, and is precipitable from its alkaline solution by acids. It is sparingly soluble in water, and is perfectly insoluble in ether. It is extracted from safflower (which has been deprived of its yellow colouring matter by washing with water) by means of carbonate of soda. From the alkaline solution it is precipitated by acetic (or citric) acid. In the moist state it is imported and sold under the name of *extract of safflower*. Spread on saucers and dried, it constitutes the *pink saucers* sold in the shops for dyeing silk. The colour which it yields is beautiful but fugitive. Dried and mixed with French chalk (talc), carthamin constitutes *rouge* (*rouge végétal*), which is used as a cosmetic. Chinese *card-rouge* is a small

¹ Duncan, *Observe. on Palm. Convuls.* 1813.

² Diebach, *Neuest. Entd. in d. Mat. Med.* S. 118, 1837. ³ *Ibid.* S. 119.

⁴ *Ann. de Chim.* t. xlviii. p. 283, 1804.

⁵ *Chemical Gazette*, vol. iv. p. 376, 1846.

folded card covered with a thin film of the colouring matter of the safflower, which in this dried state has a golden green metallic brilliancy, but which, when moistened, communicates a beautiful tint. Thin films of dried carthamin have a golden green metallic-brilliancy, like the elytra of cantharides.

Safflower is sometimes used to adulterate hay saffron. The mode of detecting the fraud has already been pointed out (see *ante*, p. 218). What is called *cake saffron* (*crocus in placenta*) is made with safflower and mucilage (see *ante*, p. 218).

The achenia of safflower are called seeds (*semina carthami*). They yield an oil by expression, and were formerly used in medicine.

Sub-order II. LABIATIFLORÆ, *De Cand.*

Flowers hermaphrodite, usually 2-lipped.

This sub-order includes two tribes; viz:—

TRIBE VI. MUTISIACEÆ.

TRIBE VII. NASSAUVIACEÆ.

Neither of these tribes contains any officinal plants.

Sub-order III. LIGULIFLORÆ, *De Cand.*

All the flowers ligulate and hermaphrodite.

TRIBE VIII. CICHORACEÆ.

Style cylindrical at the upper part; its arms somewhat obtuse, and equally pubescent.

224. TARAXACUM OFFICINALE, *Wiggers*.—COMMON DANDELION.

Sex. Syst. Syngenesia, Polygamia æqualis.
(*Radix recens*, *L.*—*Root*, *E.*)

HISTORY.—As this plant is a native of Greece,¹ it must have been known to the ancients. Sprengel² and Fraas think that it is the ἀράκη of Theophrastus.³

BOTANY. *Gen. Char.*—*Head* many-flowered. *Involucre* double; external scales small, closely pressed, spreading or reflexed; internal ones in 1 row, erect; all frequently callous-horned at the apex. *Receptacle* naked. *Achene* oblong, striated, muricate near the small ribs, or spinulose at the apex, terminating in a long beak. *Pappus* hairy, in many rows, very white. (*De Cand.*)

Sp. Char.—*Leaves* runcinate, toothed. *Achene* linear-obovate, blunt and squamously muricated at the summit, longitudinally striated, with a long beak (*Babington*).

Root perennial. *Leaves* all radical, very variable, glabrous or slightly hispid. *Scapes* single-headed, radical. *Florets* yellow.

Locality and other circumstances modify the characters of this species. Botanists are by no means agreed as to the number of its varieties. The following, considered by *De Candolle* and

¹ See *Prodr. Fl. Græcæ*, ii. 129; and *Fraas, Synops. Pl. Floræ Class.* p. 201, 1845.

² *Hist. Rei Herb.* i. 100.

³ *Hist. Plant.* vii. 21.

some others as distinct species, are regarded by Mr. Babington as mere varieties, since they are quite connected by intermediate forms:—

I. Outer involucreal scales reflexed or patent.

α. genuinum: outer scales linear, deflexed.—This variety is the *Leontodon Taraxacum* of Smith and most botanists, the *Taraxacum Dens Leonis* of De Candolle. Glabrous or woolly at the crown of the root. Leaves runcinate, broad. Flowers golden yellow. The head expanded in the morning and in fine weather. Achenes yellow. Their upper half muricated. This is the variety which should be employed in medicine.

β. levigatum: outer scales erecto-patent, ovate—*T. levigatum*, De Cand. Leaves runcinate-pinnatifid, with unequal teeth. Achenes reddish-yellow, muricated at the summit, beak with a thickened and coloured base.

γ. erythrospermum: outer scales lanceolate, adpressed or patent.—*T. erythrospermum*, De Cand. Leaves runcinate-pinnatifid, with unequal teeth and intermediate smaller ones. Achenes bright red, muricated at the summit; beak with a thickened and coloured base.—The lowermost leaves are sometimes obovate and dentate, not runcinate, when it becomes *T. obovatum*, De Cand.

II. Outer scales adpressed.

δ. palustre: outer scales ovate-acuminate—*Leontodon palustre*, Smith. Leaves oblong and entire, sinuate-dentate, or runcinate. Florets often reddish externally. Achenes pale-yellow or brown, muricated at the summit.—*Taraxacum leptorophalum*, Reichenbach, is a sub-variety, with the outer involucreal scales ovate-lanceolate or lanceolate.

Hab.—Indigenous; very common—var. *α* in meadows and pastures everywhere, *γ* in dry places, *δ* in bogs.

DESCRIPTION.—The fresh root (*radix taraxaci*) is tap-shaped, branched, fleshy, and abounding in milky juice, which resides in the laticiferous tissue called by Grew¹ "milk vessels." Externally, it is dull yellow or brownish; internally, white. It is without odour; its taste is bitter (especially in the summer). The cold watery infusion of the dried root deposits a dirty-gray flocculent precipitate on the addition of sesquichloride of iron.

Mr. Giles² states that the roots of Rough Hawkbit (*Apargia hispida*, Willd.) are sometimes substituted for those of Dandelion. They may be distinguished thus: the roots of Dandelion are smooth-skinned, tawny-coloured, crisp or easily frangible, and contain usually a milky juice; those of Hawkbit have a wrinkled cuticle, are pale-coloured, tough, break with difficulty, and rarely exhibit a milky juice. The leaves, when attached, also serve to distinguish the plants; those of Hawkbit are hairy, whereas, the leaves of the genuine variety of Dandelion are smooth.

COMPOSITION.—C. Sprengel³ analyzed the leaves and stems, and found them to consist of 85 parts of water, 9.140 of matters extractible by water (viz. albumen, mucilage, gum, and sugar), 3.091 of matters extractible by dilute caustic potash lye, 0.100 of wax, resin, and chlorophylle, and 2.669 of fibre.

The milky juice of the root has been analyzed by John,⁴ who found in it caoutchouc, bitter matter, traces of resin, sugar, and gum, free acid, phosphates, sulphates, and hydrochlorates of potash and lime, and water. Mr. Squire⁵ says the expressed juice contains gum, albumen, gluten, an odorous principle, extractive, and a peculiar crystallizable bitter principle soluble in alcohol and water.

In 1840, Frickhinger⁶ made a comparative analysis of dandelion root gathered in November, 1839, and of that collected in April, in 1840. His results were as follows:—

¹ *Anatomy of Plants*, p. 101, tab. xiii. 1682.

² *Pharmaceutical Journal*, vol. xi. p. 107. 1851.

³ *Erdmann's Techn. Journ.* Bd. v. S. 286; quoted by Wittstein (*Vollst. etymol. chem. Handwörterbuch*, Bd. 8, S. 945. 1847).

⁴ *Gunelm. Handb. de Chem.* ii. 1827.

⁵ *Reande's Dict. of Mat. Med. and Pharm.* p. 532; and *Pharm. Journal*, vol. i. p. 421.

⁶ *Buchner's Report. 2te Reihe*, Bd. xxiii. S. 45, 1840.

	Gathered in Autumn.		Gathered in Spring.	
	Fresh Root.	Root dried at 99°·5 F.	Fresh Root.	Root dried at 99°·5 F.
Extract prepared with cold water:—				
Part insoluble in alcohol (albumen, mannite, extractive, mucilage with potash, soda, and lime, combined with muriatic, sulphuric, and phosphoric acids)	6.41	23.10	1.36	6.8
Part soluble in alcohol (extractive, sugar, mannite, and chloride of potassium)	3.66	13.20	3.45	17.2
Extract prepared by boiling the root in water:—				
Part insoluble in alcohol (inulin, potash, lime, phosphoric acid, and traces of sulphuric and muriatic acid)	3.04	11.20	0.88	4.1
Part soluble in alcoholic (extractive, chloride of potassium, traces of tannin, lime, and sulphuric acid)	1.78	6.40	1.60	8.0
Albumen contaminated with some extractive . .	0.33	1.20	0.52	2.6
Wax	0.13	0.48	0.18	0.9
Residue exhausted by cold and boiling water . .	9.16	33.00	9.02	45.0
Loss ascribable to the fermentation of the inulin . .	2.94	10.62	2.86	11.3
Loss	0.32	0.80	0.19	0.8
Water	72.33	—	79.91	—
	100.00	100.00	100.00	100.00
Ashes (carbonates of potash, soda, and lime; chloride of potassium; sulphates of potash and lime; phosphate of lime; and silica)	5.5	—	7.8	—

From these analyses, it appears that the root gathered in the autumn is richer in those ingredients which are extractible by water than the root collected in the spring; whereas, the latter contains more albumen, wax, and mineral constituents (ashes).

Dandelion root washed, crushed, and pressed, yields about half its weight of juice. Except in the months of April and May, when it is very aqueous, this juice spontaneously coagulates, and becomes of a fawn colour. The quantity of extract obtained from the juice varies at different seasons.¹

	Juice.
In January and February	4 to 5 lbs. yield 1 lb. of extract.
In March	6 to 7 lbs. ditto.
In April and May	8 to 9 lbs. ditto.
In June, July, and August	6 to 7 lbs. ditto.
In September and October	4 to 5 lbs. ditto.
In November and December	4 lbs. ditto.

It is obvious, then, that the expressed juice is richest in solid constituents in the months of November and December. It is remarkable, however, that the juice possesses the greatest bitterness in the summer months; while in the spring, and late in the autumn, it has a remarkably sweet taste.² Squier considers this change to be effected by the frost.

1. **TARAXACIN; Dandelion-bitter.**—This, which is probably the active principle of the root, is obtained by receiving the milky juice in distilled water, heating the liquid to boiling, by which the resin and albumen are separated, filtering the liquid when cold, and slowly evaporating so that crystals may be formed. These may be purified by washing, and by solution in ether distilled water or alcohol. Pure taraxacin occurs in stellated and dendritic masses, has a bitter and somewhat acrid taste, and is readily soluble in ether, alcohol, and boiling water, but difficultly so in cold water. It is easily fusible and inflammable, burns without developing ammonia, dissolves in concentrated acids without producing any colour, and is neutral to test papers.³

2. **RESIN.**—The resin obtained from the milky juice is white, crystallizable, soluble in alcohol and ether, but insoluble in caustic alkalies. Its spirituous solution has an acrid taste, and yields no precipitate on the addition of acetate of lead.

3. **INULIN.**—According to Overbeck,⁴ the root collected in the spring yields very little inulin; but 1½ of the dried root collected in the autumn yielded him 2½ ounces of the inulin.

4. **SUGAR.**—This has been obtained from dandelion root by Widmann,⁵ by Fricklinger,⁶ and by the Messrs. Smith.⁷ It readily undergoes decomposition in the watery infusion of the root, and probably becomes converted into mannite and lactic acid.

¹ Squire, *op. cit.*

² Pulex, *Arch. d. Pharm.* Bd. xix.; *Berlinisches Jahrb. für d. Pharm.* Bd. xlii. S. 200, 1839; and *Pharmaceutical Journal*, vol. i. p. 425.

⁴ *Arch. d. Pharm.* Bd. xxiii. S. 240.

⁶ *Op. supra cit.*

³ Geiger, *Handb. d. Pharm.*

⁵ Buchner's *Repert.* Bd. xliii. S. 241. 1832.

⁷ *Pharmaceutical Journal*, vol. viii. p. 470. 1849.



Messrs. T. and H. Smith have confirmed the accuracy of Frickhinger's opinion—that mannite does not pre-exist in taraxacum, but is a product of the decomposition of the sugar. I am indebted to them for a beautiful specimen of mannite procured from the infusion of dandelion.

PHYSIOLOGICAL EFFECTS.—Its obvious effects are those of a stomachic and tonic. In large doses it acts as a mild aperient. Its diuretic operation is less obvious and constant. In various chronic diseases its continued use is attended with alterative and resolvent effects. But where the digestive organs are weak, and readily disordered, taraxacum is very apt to occasion dyspepsia, flatulency, pain, and diarrhoea.

USES.—It is employed as a resolvent, aperient, and tonic, in chronic diseases of the digestive organs, especially hepatic affections; as jaundice, chronic inflammation or enlargement of the liver, dropsy dependent on hepatic obstruction, and dyspepsia attended with deficient biliary secretion. In some very susceptible conditions of the stomach it proves injurious. It has been employed in affections of the spleen, chronic cutaneous diseases, uterine obstructions, &c.

ADMINISTRATION.—It is employed in the form of either *decoction* or *extract*. A mixture of coffee and either powder or extract of dandelion has been used at table under the name of *taraxacum* or *dandelion coffee*; and a mixture of four parts of dandelion powder with one part of chocolate constitutes the so-called *dandelion chocolate*.

[1. INFUSUM TARAXACI, U. S.—Take of Dandelion, bruised, ℥ij, Boiling Water Oj. Macerate for two hours in a covered vessel and strain. Dose, f℥i—ij.]

2. DECOCTUM TARAXACI, L. E.; *Decoction of Dandelion*.—(Fresh Taraxacum root ℥iv; Distilled Water Oiss. Boil to a pint and strain, L.—Taraxacum, herb and root, fresh, ℥vij; Water Oj. Boil to a pint and strain, E.)—Aperient and tonic. Dose, f℥j to f℥ij. To increase its aperient property, a saline purgative may be conjoined.

3. EXTRACTUM TARAXACI, L. E. [U. S]; *Extract of Dandelion*.—(Fresh Root of Taraxacum, bruised, lbiss [lbj, E.]; Boiling Distilled Water Cong. ij [Cong. j, E.]. Macerate for twenty-four hours, then boil down to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence, L. "Proceed as for the preparation of extract of poppyheads," E.)—Mr. Jacob Bell¹ states that the following are the quantities of extract of taraxacum obtained by him from the root at different periods of the year:—

	lbs. of Extract obtained in							
	Jan.	Feb.	March	April	Aug	Oct.	Nov.	Dec.
1 cwt. of taraxacum root yielded	8½	6½	6	5	6	9	8½	9

These are the average deductions from his laboratory-book during several years.

[The following directions are given by the U. S. Pharm. Take of Dandelion, gathered in September, lbv. Slice the dandelion, bruise it in a stone mortar, sprinkling on it a little water, until reduced to a pulp; then express the juice, strain, and evaporate in a vacuum, or in a shallow dish over a water-bath, constantly stirring to the proper consistence.—J. C.]

Extract of Taraxacum should be brownish, not blackish. Its taste is bitter and aromatic; that of the shops is usually more or less sweet. It should be completely soluble in water.—Dose, grs. x to ℥ss.

¹ *Pharmaceutical Journal*, vol. x. p. 446.

225. *Cichorium Intybus*. Linn.—Wild Succory or Chicory.

Ses. Syst. Syngenesia, Polygamia æqualis.

(Radix.)

Κίχλριον. Theophrast. Hist. Plant. lib. vii. cap. 11; σίχρις στενὸφυλλος καὶ ἔμπικρος [narrow-leaved and bitterish Seri-]. Dioscorides. lib. ii. cap. 160; *Intybum erraticum*, called by some *ambula* [or *ambugia*], and in Egypt *Cichorium*. Pliny, Hist. Nat. lib. xx. cap. 29, ed. Valp.

Stem 2—3 feet high, bristly, alternately branched. Lower leaves runcinate, hispid in the keel; upper ones oblong or lanceolate, clasping, entire. Flower-heads axillary, in pairs, nearly sessile, bright blue, sometimes white, about the size of those of dandelion. Involucrum roughish. Corolla, anthers, and stigmas, blue. Fruit angular.—A perennial herb; indigenous, growing on banks on a gravelly and chalky soil. Flowers in July and August. Cultivated in various parts of England; also in Belgium, Holland, Germany, and France.

The root (*radix cichorii sylvestris* vel *agrestis*) is spindle-shaped, with a single or double head; externally, it is whitish or grayish-yellow; internally, it is whitish, fleshy, and milky. Its taste is bitter. English roots are usually smaller and more fibrous than the foreign roots.

Both in the raw and roasted roots, the structures which are observed by microscopic examination are cellular tissue, pitted tissue (dotted ducts), vascular tissue (spiral vessels), and lactiferous tissue (milky vessels). The dotted ducts are unbranched; the milk vessels, on the contrary, are anastomosing vessels.¹

No recent analysis of the root has been made. John² obtained from 100 parts, 25 parts of watery bitter extractive, 3 parts of resin, besides sugar, sal ammoniac, and woolly fibre. Wail³ procured inulin from it. In one experiment, half a pound (civil weight) of the root yielded him one ounce of good dry inulin; but, in another much sweeter root, he found not a trace of inulin. Hence, he inferred that the sugar had been formed at the expense of the inulin. An infusion of the root, mixed with syrup, becomes thick; forming the *gomme saccho-cichorine* of Lacaterie.⁴

The fresh root is seldom or never used at the present day as a medicine. Its medicinal properties appear to resemble those of dandelion. It is reputed to possess tonic, alterative, resolvent, diuretic, and, in large doses, aperient qualities; and it was formerly employed in chronic diseases of the abdominal viscera, jaundice, hypochondriasis, &c. Its protracted use is said to injure digestion. It is administered in the form of decoction, prepared by boiling 3ss of the dried root, in Oj of water, to f3 viij.⁵

RADIX CICHORII TORREFACTA; Roasted Chicory Root.—On the large scale, chicory root is roasted in heated iron cylinders, which are kept revolving, as in the process of coffee-roasting. The loss during the process is from 25 to 30 per cent.

During the roasting process, about 2 lbs. of lard for every cwt. of chicory are added. This substance is intended to give the chicory a face or lustre like that of coffee.⁶ While roasting, chicory evolves a not disagreeable odour, which somewhat resembles that of burnt gingerbread.

Roasted chicory, when ground to powder, constitutes the *chicory* sold for the adulteration of coffee, and sometimes called *chicory-coffee*. The adulteration of coffee with chicory can be detected by the microscope, as well as by chemical means (see *Coffea arabica*).

Roasted chicory powder, when thrown on water, rapidly imbibes this fluid—to which it communicates a reddish-brown colour—and falls to the bottom of the vessel. A decoction of roasted chicory is merely rendered brown by iodine, and neither strikes a blue colour with iodine nor becomes black on the addition of the sesquichloride of iron.

When submitted to microscopic examination, roasted chicory presents the same tissues which are observed in the raw root; the operation of roasting not having destroyed them.

Roasted chicory is extensively adulterated. To colour it, Venetian red (see vol. i. p. 724), and perhaps reddle, are used. The former is sometimes mixed with the lard before this is introduced into the roasting machine, at other times it is added to the chicory during the process of grinding. Roasted pulse (peas, beans, and lupines),⁷ corn (rye and damaged wheat), roots (parsnips, carrots, and mangel-wurzel), bark (oak bark tan), wood-dust (logwood and mahogany dust), seeds (acorns and horse-chestnuts), the marc of coffee, coffee-husks (called *coffee-flights*), burnt sugar, baked bread, dog biscuit, and the baked livers of horses and bullocks (!), are substances which are said to have been used for adulterating chicory. A mixture of roasted pulse (peas usually) and Venetian red has been used, under the name of *Hambro' powder*, for the same purpose.⁸

¹ Figures of some of these tissues are given in the *Lancet* for March 15, 1851.

² *Chem. Tabelle d. Pflanzenanalysen*, p. 81 (quoted by Kunze).

³ *Buchner's Repertorium*. Bd. xxvii. S. 263, 1827.

⁴ Fée, *Cours d'Hist. Nat.* t. ii. p. 301, 1823.

⁵ Wylie, *Pharm. Castrens. Rutlenica*, 1840.

⁶ In France, butter is used instead of lard. This addition is by some said to "fix" the red powders used for the adulteration of chicory (Chevallier, *Journ. de Chim. Méd.* t. v. 3me Ser. p. 280, 1849).

⁷ Lupine seeds are said to be imported from Egypt, and, when roasted and ground, are sold under the name of "Coffina," (*Lancet*, March 15, 1851.)

⁸ For farther details respecting the adulteration of chicory, see a paper by the author in the *Pharma-*

The following are the chief modes of examining chicory with a view to the detection of these adulterations:—

1. Careful examination of the odour, flavour, and appearance to the naked eye, of the suspected powder. In this way foreign substances may sometimes be detected.

2. A portion of the dried powder is to be thrown on water; the chicory rapidly imbibes the water, and falls to the bottom, whereas some intermixed powders (as the marc of coffee) float.

3. The suspected powder is to be submitted to careful microscopical examination. Pulse and corn may be detected by the size, shape, and structure of the starch grains. The tissues of larks, woods, and other roots, may also be frequently distinguished from those of chicory.

4. A decoction of the suspected chicory is then to be prepared, and, when cold, to be tested with solution of iodine and persulphate of iron.

Iodine colours a decoction of pure chicory brownish; whereas it produces a purplish, bluish, or blackish colour with decoctions of roasted pulse, roasted corn, baked bread, roasted acorns, and other substances containing starch.

Persulphate or perchloride of iron does not produce much effect on a decoction of pure chicory; but it communicates a bluish or blackish tint to a decoction of oak-bark, of roasted acorns, and other substances containing tannic or gallic acids.

5. By incineration, pure dried chicory yields from 4 to 5 per cent. of a gray or fawn coloured ash. If Venetian red or any earthy or other mineral substances be present, a larger amount of ash is obtained. Moreover, when Venetian red has been employed, the colour of the ash is more or less red.

Roasted chicory has been in use as a substitute for coffee for more than eighty years,¹ and, at the present time, is extensively employed for adulterating coffee. It is, however, devoid of that fine aromatic flavour for which coffee is so much admired. By some persons it is said to be both wholesome and nutritive, by others it is declared to be neither the one nor the other. The fact is, that no obvious ill effects are usually observed by the use of chicorized coffee; but there can be no doubt that roasted chicory must, when taken largely, have a tendency to excite diarrhoea. It scarcely deserves to be called nutritive, since, with the exception of sugar, it is almost entirely devoid of nutritive principles.

ORDER LV. VALERIANACEÆ, *Lindl.*—VALERIANWORTS.

VALERIANEÆ, *De Candolle.*

CHARACTERS.—Tube of the *calyx* adnate to the ovary; the limb various, either dentate or partite, or changed into a pappus, which is at first involute, afterwards expanded. *Corolla* tubular, funnel-shaped; usually 5-lobed, rarely 3- or 4-lobed; lobes obtuse; tube equal or gibbous, or calcarate at the base. *Stamens* adnate by their *filaments* to the tube of the corolla; free at the apex; alternate with the lobes of the corolla; 5 (the type), 4, 3, 2, or solitary; *anthers* ovate, bilocular. *Style* filiform; *stigmas* 2 or 3, free or cohering. *Fruit* membranous or somewhat nucamentaceous, indehiscent, crowned, at least when young, with the limb of the calyx, either 3-celled (2 cells being empty) or 1-celled. *Seeds*, in the fertile cell or fruit, solitary, pendulous, exalbuminous; *embryo* erect, with a superior radicle and 2 flat cotyledons. (*De Cand.*) Annual or perennial herbs, rarely at the base somewhat shrubby. *Roots* of the perennial species odorous. *Leaves* opposite, without stipules. *Flowers* cymose-corymbose.

PROPERTIES.—The rhizomata and their rootlets contain a peculiar odorous volatile oil, on which their nervine and antispasmodic qualities essentially depend.

226. VALERIANA OFFICINALIS, *Linn.*—COMMON VALERIAN.

Sex. Syst. Triandria, Monogynia.
(*Herbæ sylvestris radix*, *L.*—Root, *E. D.*)

HISTORY.—The earliest writer who notices this plant is Fuchsius. The *φoν* of Dioscorides (lib. i. cap. x.) is not *Valeriana sylvestris*, as Hoffman supposed, but *V. Dioscoridis*.²

BOTANY. *Gen. Char.*—Limb of the *calyx* involute during flowering, then un-

critical Journal, vol. iv. p. 119; also Chevallier, *Journ. de Chim. Méd.* t. v. p. 276, 3me Série, 1840; and *The Lancet* for January 4, March 15, May 10, and Nov. 1, 1851.

¹ F. G. Constantini, *Nachricht von d. Cichorienwurzel*, Hanover, 1771; C. G. Förster, *Geschichte von d. Erfindung u. Einführung d. Cichorien-Coffee*, Bremen, 1773. See also Chevallier, *Journ. de Chim. Méd.* t. v. p. 276, 3me Série, 1849.

² Smith, *Prod. Fl. Græcæ*, vol. i. p. 21; and Fraus, *Synops. Plant. Fl. Classica*, p. 217, 1845.

rolled into a deciduous pappus, consisting of many plumose setæ. Tube of the corolla oboconical or cylindrical, equal at the base or gibbous, without a spur; limb obtusely 5-cleft, rarely 3-cleft. Stamens 3. Fruit indehiscent; when ripe, 1-celled, 1-seeded. (De Cand.)

Sp. Char.—Leaves all pinnate; leaflets in 7—10 pairs, lanceolate, dentate-serrate or quite entire; stem furrowed; root 1-stalked, stoloniferous. Flowers flesh-coloured. Fruit smooth or pubescent (Koch. Syn. Fl. Germ. ed. 2).

Herbaceous, perennial, from 2 to 6 feet high. Root fibrous. Flowers in June.

Hab.—Most countries of Europe.

This species is subject to variation.

α. major, Koch; *latifolia*, Hayne; *V. palustris major*, C. Bauhin; Larger, Broad-leaved, or Taller Common Valerian.—Stem taller; leaflets broader, all toothed. Grows in moist localities, as ditches, marshes, and the banks of pools and rivers.

β. minor, Koch; *angustifolia*, Hayne; *V. angustifolia* Tausch, De Cand.; *V. officinalis* var. *β*. Smith, Engl. Bot. vol. i. p. 43, 1824; *V. officinalis* var. *α* *foliis angustioribus*, Woolville, Med. Bot. t. 96; *V. sylvestris major montana*, C. Bauhin; Smaller, Narrow-leaved, or Mountain Common Valerian.—Stem shorter, leaflets narrower (linear-lanceolate), entire, or the lower ones few toothed.—Grows on dry heaths and elevated pastures.—Roots more odorous, and, therefore, to be preferred for medicinal use.

COLLECTION.—The Valerian root of the shops is collected about August and September from both wild and cultivated plants. I am informed that the roots of the wild sort are now gathered chiefly in Hampshire; but Hill¹ states that, in his time, the heaths of Kent and Essex furnished a great deal of it.

The cultivation of valerian is carried on at Ashover, near Chesterfield, in Derbyshire. The plants are either procured from the offsets of former plantations, or from wild plants found in wet places in the neighbouring woods. Soon after the plant “comes up in the Spring, the tops are cut off, to prevent its running to seed, which spoils it. At Michaelmas, the leaves are pulled and given to cattle, and the roots dug up carefully, and clean washed, and the remaining top is then cut close off, and the thickest part slit down to facilitate their drying, which is effected on a kiln, after which they must be packed tight, and kept very dry, or they spoil. The usual produce is about 18 cwt. per acre.”²

DESCRIPTION.—The root (*radix valerianæ*) consists of a short tuberculated, underground stem or rhizome, from which issues one or more creeping shoots or stoles, and numerous round tapering root-fibres, which are from 2 to 6 inches long, whitish internally, and, when fresh, grayish or yellowish white externally, but when dried, yellowish brown. They give origin to fibrillæ or rootlets.

The taste of the root is warm, camphoraceous, slightly bitter, somewhat acrid, and nauseous. The odour of the fresh roots is not very considerable, but of the dry, especially when they have been kept for some time, much stronger; it is fetid, very characteristic, and highly attractive to cats, and, it is said, to rats also.

Two varieties of valerian root are found in English commerce, viz.: the cultivated, which, being finer looking, is usually kept by druggists; and the uncultivated or wild sort (*herbæ sylvestris radix*, L.; *radix valerianæ sylvestris*), which is more fragrant, and, therefore, to be preferred for medicinal use.

COMPOSITION.—In 1809, a quantitative analysis of this root was made by Trommsdorff;³ and in 1834 this chemist made a second analysis of it,⁴ but he did not determine the relative proportion of the constituents. He found a peculiar volatile oil combined with valerianic acid, starch, albumen, peculiar extractive matter (valerianin), yellow extractive matter, soft or balsamic resin, mucilage, valerate of potash, malates of potash and lime, sulphate and phosphate of lime, silica, and woody fibre. The ligneous matter constitutes, on an average, about five-eighths of the whole. Of the soluble constituents the valerianin is the most abundant,

¹ History of the Materia Medica, p. 581, 1751.

² Encyclop. of Agriculture, pp. 945 and 1152

³ Trommsdorff's Journal d. Pharm. xvii. 1809: Bulletin d. Pharmacie, t. i. p. 209, 1809

⁴ Ann. der Pharm. Bd. x.; also Pharm. Central-Blatt für 1831, S. 742.

and next to this the mucilage. The balsamic resin amounts to about half the weight of the valerianin.

1. **VOLATILE OIL OF VALERIAN** (*Oleum Valerianæ*).—According to Hurault,¹ this oil does not exist ready-formed in valerian root, but is produced only by the action of water; for pure ether does not extract any volatile oil from the root. When the root is submitted to distillation with water, the distillate consists of water, on which the oil floats. Martius obtained three ounces of oil from twelve pounds of the dried root, and Bartels eleven ounces from fifty pounds of the root.

Crude oil of valerian is a mixture of at least five substances, whose relative proportions vary with the age and mode of preservation of the oil. Of these five substances, two are volatile oils, and may be regarded as the essential components of the oil. The more volatile of these is *borneol*, $C^{10}H^{16}$, a colourless liquid identical with a carbo-hydrogen obtained from *Borneo* camphor. In odour it resembles oil of turpentine, with which it is isomeric. The less volatile ingredient is *valerol*, $C^{12}H^{10}O^2$, which is lighter than water, has an odour of hay, and by exposure to the air absorbs oxygen and yields valerianic acid. The three non-essential constituents of the oil are *valerianic acid*, a *resin*, and a kind of *camphor* or solid volatile oil.²

Fresh prepared and rectified oil of valerian is neutral, clear, with an odour which is not disagreeable. By exposure to the air it resinifies, becomes coloured, thick, acid (owing to the formation of valerianic acid), and acquires a more disagreeable odour.

Oil of valerian has been used in medicine, as a powerful stimulant and antispasmodic, in doses of one or two or more drops.

2. **VALERIANIC OR VALERIC ACID** (*Acidum Valerianicum*). $C^{10}H^9O^3.HO$.—It is considered by some to be identical with phœnic acid obtained by Chevreul from whale oil. It can be procured from valerian root and the fruit of *Viburnum Opulus*, in both of which according to some persons, it pre-exists. But in valerian root it is probably formed by the oxidation of valerol. When this root is submitted to distillation with water, the distillate usually contains valerianic acid. Rabourdin³ by previously acidulating the water with sulphuric acid, obtained 231 grains of valerianic acid from $4\frac{2}{3}$ lbs. of the root; whereas, when simple water was employed, the product was only 77 grains of acid. By Rabourdin's process, Aschoff⁴ produced 183 drachms of acid from 15 lbs. of root. Lefort⁵ advises that prior to distillation the coarsely powdered root should be macerated in water mixed with sulphuric acid and bichromate of potash, in order to promote the oxidation of the valerol, and thereby to increase the product of valerianic acid. He obtained by this method from 262 to 285 grains of valerianate of zinc from 24 lbs. avoirdupois of the root. By boiling the root in a solution of carbonate of soda, and decomposing the saline solution by sulphuric acid, the Messrs. Smith⁶ procured four scruples of acid from a pound of root. Thirault⁷ is of opinion that caustic alkali is preferable to the carbonate.

But valerianic acid is a product of the decomposition of various animal and vegetable substances, and is most economically obtained, for commercial purposes, from oil of grain (*fusel oil*). (See *Soda valerianus*, Ph. Dubl. p. 1583.)

Valerianic acid is a colourless limpid liquid. Its odour is strong, and somewhat allied to, though distinct from that of valerian root; its taste is acid. Its density, at $60^\circ F$, is 0.937. It boils at $347^\circ F$. It is very slightly soluble in water, with which it forms a hydrate. $C^{10}H^9O^3.HO$; but is soluble in all proportions in alcohol and in ether. With the exception of the valerianates of silver and the protoxide of mercury, all the valerianates are soluble in water.⁸

3. **VALERIANIN; Peculiar Extractive Matter**.—A yellowish-brown substance, which tastes at first sweetish, afterwards slightly bitter. It is soluble in water, but is insoluble in both alcohol and pure ether. Neither sesquichloride of iron nor acetate of lead produce any change in the aqueous solution.

4. **YELLOW EXTRACTIVE MATTER**.—Bitterish, soluble in water. The sesquichloride of iron causes a green precipitate, and acetate of lead a dirty yellow precipitate, in the aqueous solution.

5. **RESIN**.—Insoluble in water, but soluble in alcohol, ether, and oil of turpentine. The alcoholic solution does not redden litmus, nor yield any precipitate, on the addition of an alcoholic solution of either acetate of lead or acetate of copper.

PHYSIOLOGICAL EFFECTS.—Valerian excites the cerebro-spinal system. Large

¹ *Journ. de Pharm. et de Chim.* t. xii. p. 69, 1847.

² Gerhardt, *Ann. d. Chem. u. Pharm.* Bd. xlv. S. 29, 1843.

³ *Journ. de Pharm. et de Chimie*, 3me ser. t. vi. p. 310, 1844.

⁴ *Pharmaceutisches Central-Blatt für 1847*, p. 281.

⁵ *Journ. de Pharm. et de Chimie*, 3me ser. t. x. p. 194, 1846.

⁶ *Pharmaceutisches Central-Blatt*, vol. v. p. 110, 1845.

⁷ *Journ. de Pharm. et de Chimie*, 3me ser. t. xii. p. 161, 1847.

⁸ For mode of separating valerianic from butyric and acetic acids, see Liebig, *Chemical Gazette*, vol. viii. p. 24, 1850.

doses cause headache, mental excitement, visual illusions (scintillation, flashes of light, &c.), giddiness, restlessness, agitation, and even spasmodic movements. Barbier¹ says that a patient in the Hôtel-Dieu d'Amiens, who took six drachms of the root daily in the form of decoction, awoke up suddenly out of his sleep, and fancied he saw one side of the room on fire. Its operation on the nervous system is also evinced by its occasional therapeutic influence over certain morbid states of this system; whence it has been denominated *nervine* (*nervino-alterative*) and *anti-spasmodic* (see vol. i. pp. 251 and 254). Farthermore, it intoxicates cats (who are very fond of it). Under its influence these animals roll themselves on the ground in "outrageous playfulness," and are violently agitated. However, the before-mentioned effects of valerian on the nervous system of man are by no means constant; whence practitioners have lost confidence in it as a remedial agent. "Yet I have met with some," observes Dr. Heberden,² "whom it threw into such agitations and hurries of spirits, as plainly showed that it is by no means inert." More inconstant still are its effects on the functions of organic life. For while in some cases it has accelerated the pulse, augmented the heat of the body, and promoted the secretions,³ in others it has failed to produce these effects.⁴ Large doses often create nausea.

USES.—Valerian may be employed as a nervous excitant, and, where stimulants are admissible, as an antispasmodic. It was formerly in great repute. It has been principally celebrated in *epilepsy*. It came into use in modern times through the recommendation of Fabius Columna, who reported himself cured by it, though it appears he suffered a relapse.⁵ Its employment has found numerous advocates and opponents;⁶ but at the present time practitioners regard it as a medicine of very little power. In the few cases in which I have employed it, it has failed to give the least relief. In some of the milder and more recent forms of the disease, neither dependent on any lesion within the cranium nor accompanied with plethora, as in hysterical epilepsy, it may occasionally prove serviceable. In *chorea*, and other spasmodic affections, it has been used with variable success. I have found temporary benefit from its use in females affected with *hypochondriasis* and *hysteria*. Of its use as a nervous stimulant in the low forms of *fever*, we have but little experience in this country. In Germany, where it is more esteemed, its employment in these cases is spoken highly of.⁷

ADMINISTRATION.—The dose of the *powder* is from ℥j to ʒj, or even ʒij. Though objected to by some on account of the quantity of inert woody fibre which it contains, it is, when well and recently prepared, an efficacious form for administration.

1. INFUSUM VALERIANÆ, L. D. [U. S.]; *Infusion of Valerian*.—(Valerian Root, bruised, ʒss [ʒij, D.]; Boiling [distilled, L.] Water Oj [ʒix, D.]. Macerate for half an hour [an hour, D.] in a covered vessel, and strain.)—This infusion contains a small quantity of volatile oil, some valerianate of potash (Trommsdorff), and extractive matter, but no resin.—Dose, fʒj to fʒij. This preparation is somewhat less apt to disturb the stomach than the powder.

2. TINCTURA VALERIANÆ, *Tincture of Valerian*, L. E. D. [U. S.].—(Valerian, bruised, ʒv [ʒiv, U. S.]; Proof Spirit Oij; [Diluted Alcohol Oij, U. S.] Macerate for seven [fourteen, D.] days, then express and strain, L. D. "Proceed by percolation or digestion, as for tincture of cinchona," E.)—Dose, fʒj to fʒiv. This preparation contains a portion of volatile oil, some valerianate of potash, valerianin, and resin. Though it possesses the virtues of valerian, it is scarcely sufficiently strong to produce the full effects of the root, without giving it in doses so large as to be objectionable, on account of the spirit contained therein.

¹ *Mat. Méd.* 2de ed. ii. 83.

² See Carminati *Opusc. Ther.* i. 238; Jörg, *Journ. de Chim. Méd.* vii. 275.

³ Troussseau and Pidoux, *Traité de Thérap.* i. 1 and 2.

⁴ See Copland's *Dict. of Med.* i. 805.

⁵ Richter, *Ausf. Arzneimittel.* iii. 23; Sundelin, *Heilmittell.* ii. 126.

⁶ *Comment.* ch. 69.

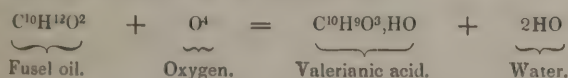
⁷ 6.

⁸ Murray, *App. Med.* i. 275.

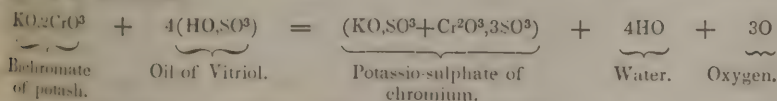
3. *TINCTURA VALERIANÆ COMPOSITA*, L.; *Tinctura Valerianæ ammoniata*, E.; *Ammoniated Tincture of Valerian*.—(Valerian, bruised, ℥v; Aromatic Spirit of Ammonia [Spirit of Ammonia, E.], Oij. Macerate for seven days, then express and strain, *L.* “Proceed by percolation or by digestion in a well-closed vessel, as directed for tincture of cinchona,” *E.*)—Dose, f℥ss to f℥j. The stimulant influence of the valerian is greatly increased, and its therapeutical efficacy oftentimes augmented, by the ammonia in this preparation.

[4. *EXTRACTUM VALERIANÆ FLUIDUM*, [U. S.] *Fluid Extract of Valerian*.—(Take of Valerian in coarse powder ℥viiij; Ether f℥iv; Alcohol f℥xij. Diluted Alcohol a sufficient quantity. Mix the Ether and Alcohol, and having incorporated the Valerian with one-half of the mixture, introduce the mass into a percolator, and gradually pour in the remainder; then add Diluted Alcohol until the whole liquid which has passed shall amount to a pint. Put the ethereal liquid thus obtained into a shallow vessel, and allow it to evaporate spontaneously until reduced to f℥v. Upon the mass in the percolator pour gradually Diluted Alcohol until f℥x of tincture have passed. With this mix the f℥v left after the spontaneous evaporation, taking care to dissolve in a little alcohol any old resinous matter which may have been deposited, and add it to the rest. Allow the mixture to stand, with occasional agitation, for four hours and then filter. The resulting Fluid Extract should measure a pint, and if it be less than that quantity, the deficiency should be supplied by the addition of alcohol. From its concentration this is an excellent preparation.)—Dose, gtt. xx—xl, in a little water.]

5. *SODÆ VALERIANAS*, D.; *Valerianate of Soda*.—(Take of Bichromate of Potash, reduced to powder, ℥ix; Fusel Oil f℥iv; Oil of Vitriol of commerce f℥viiss; Water Cong. ss; Solution of Caustic Soda Oj; or as much as is sufficient. Dilute the Oil of Vitriol with ten ounces, and dissolve with the aid of heat the Bichromate of Potash, in the remainder of the water. When both solutions have cooled down to nearly the temperature of the atmosphere, place them in a matrass, and, having added the Fusel Oil, mix well by repeated shaking, until the temperature of the mixture, which first rises to about 150°, has fallen to 80° or 90°. The matrass having been now connected with a condenser, heat is to be applied so as to distil over about half a gallon of liquid. Let this, when exactly saturated with the solution of caustic soda, be separated from a little oil that floats on its surface, and evaporated down until, the escape of aqueous vapour having entirely ceased, the residual salt is partially liquefied. The heat should now be withdrawn; and when the valerianate of soda has concentered, it is, while still warm, to be divided into fragments, and preserved in a well-stopped bottle, *D.*)—Fusel Oil, also called Oil of Grain or Amylic Alcohol (*alcohol amylicum*, Ph. Dub.), is transformed, under oxidizing influences, into valerianic acid and water.



In the process of the Pharmacopœia, the oxygen is derived from the chromic acid of the bichromate of potash. When this salt is subjected to the action of sulphuric acid, the products are—oxygen (which is eliminated), water, and potassio-sulphate of chromium.



The valerianic acid, being volatile, distils over, and is neutralized by caustic soda. The solution of valerianate of soda is then to be evaporated to dryness, and the residual salt partially liquefied to obtain it in the anhydrous state.

Valerianate of soda (NaO, Va) crystallizes with difficulty, but may be obtained in a cauliflower-like mass. It begins to fuse at 268° , and on cooling forms a white solid mass, which has a greasy or soapy feel. Its odour resembles that of the acid; its taste is sweet, but nauseous. It is deliquescent, and soluble in both water and alcohol. Heated in a platinum capsule, it first fuses, then decomposes, evolves a vapour which burns with a yellow flame, and leaves a residue of carbonate of soda. If to an aqueous solution of the valerianate of soda, hydrochloric acid be added, the valerianic acid is set free, and floats on the solution.

Valerianate of soda is used for the preparation of other valerianates; as those of iron, quinia, and zinc.

6. *ZINCI VALERIANAS*, D.; *Valerianate of Zinc*.—(Take of Valerianate of Soda ℥iiss ; Sulphate of Zinc ℥ij and ℥vij ; Distilled Water Oij . Dissolve the valerianate of soda in one-half, and the sulphate of zinc in the remaining half of the water, and, having raised both solutions to 200° , mix them, and skim off the crystals which are produced. Let the solution be now evaporated at a temperature not exceeding 200° , until it is reduced to the bulk of four ounces, removing, as before, the crystals from the surface, in proportion as they form, and placing them with those already obtained. The salt thus procured is to be steeped for an hour in as much cold water as is just sufficient to cover it, and then transferred to a paper filter, on which it is to be first drained, and then dried at a heat not exceeding 100°)—By the mutual action of valerianate of soda and sulphate of zinc, we obtain sulphate of soda and valerianate of zinc; the former salt remains in solution, while the latter separates and floats on the solution. Prepared in this way, valerianate of zinc is anhydrous, and its composition is represented by the formula ZnO, Va . But if valerianate of zinc be prepared by stirring carbonate of zinc with so little water as to form a paste, and adding the calculated quantity of valerianic acid, we obtain an hydrated salt whose composition is $\text{ZnO}, \text{Va}, 12\text{HO}$.¹

The anhydrous salt crystallizes in snow-white pearly plates, like boracic acid. It has a faint odour of valerianic acid, and a metallic astringent taste combined with that of the acid. It dissolves in 160 parts of cold water, and in 60 parts of alcohol. The solutions have an acid reaction, become turbid on the application of heat, but become again clear on cooling. Cold ether takes up only $\frac{1}{50}$ th, boiling ether $\frac{1}{20}$ th, of the salt.² The hydrated salt is more soluble, and requires only 44 parts of water to dissolve it.

Valerianate of zinc is subject to adulteration. According to Laroque and Huraut,³ butyrate of zinc is sometimes substituted for it. To detect this, add sulphuric acid, and subject the mixture to distillation to separate the volatile acid. If this be butyric acid, it immediately causes a bluish-white precipitate when added to a concentrated solution of acetate of copper; whereas, valerianic acid causes no precipitate; but, on shaking it with the solution, it gives rise to some oily drops of anhydrous valerianate of copper. Another fraud consists in substituting acetate of zinc flavoured with oil of valerian. This may be distinguished by its odour, and by its yielding acetic ether (recognized by its odour), when mixed with a little proof spirit and one-fourth the volume of oil of vitriol.⁴

This salt was first introduced into medicinal use by Prince Louis Lucien Bonaparte.⁵ Its physiological effects are not very obvious; they have been assumed, however, to combine those of valerian and zinc. But, before this is admitted, it must be shown that valerianic acid is the essential active ingredient of valerian, which I do not believe to be the case. Dr. Devoy⁶ states that, in doses of $2\frac{1}{2}$ grains, it produces a little headache, slight vertigo, and some confusion of hearing.

Valerianate of zinc has been employed in medicine as an antispasmodic, chiefly in neuralgia, but also in some other neuroses—as epilepsy. It is reported by several

¹ Wittstein. *Buchner's Repertorium*. 3tte Reihe, Bd. i. S. 189, 1848.

² Wittstein. *Ibid*. 2ter Reihe, Bd. xxxvii. S. 302, 1845.

³ *Chemical Gazette*, vol. iv. p. 302, 1846.

⁴ *Pharmaceutical Journal*, vol. viii. p. 577, 1849.

⁵ *Journ. de Chim. Méd.* t. ix. 2de sér. p. 336, 1843; and *Pharm. Journ.* vol. iv. p. 131, 1844.

⁶ *Journ. de Pharm.* 3me sér. p. 141, 1844; and *Chemical Gazette*, vol. ii. p. 469, 1844.

practitioners to have produced beneficial results; but, although I have repeatedly employed it, I am unable to report favourably of its effects.¹

The dose of it is from one to six or more grains. It may be administered either in the form of pill, or dissolved in water. As a topical astringent and sedative, it has been employed in chronic conjunctivitis, in the form of collyrium, prepared by dissolving from 2 to 4 grains of the salt in two ounces of distilled water.

7. FERRI VALERIANAS, D.; *Valerianate of the Sesquioxide of Iron*; *Valerianate of Iron*.—(Take of Valerianate of Soda $\mathfrak{z}\text{v}$ and $\mathfrak{z}\text{ij}$; Sulphate of Iron $\mathfrak{z}\text{iv}$; Distilled Water Oj. Let the sulphate of iron be converted into a persulphate, as directed in the formula for *Ferri Peroxydum Hydratum*, and, by the addition of distilled water, let the solution of the persulphate be augmented to the bulk of eight ounces. Dissolve the valerianate of soda in ten ounces of the water, then mix the two solutions cold, and, having placed the precipitate which forms upon a filter, and washed it with the remainder of the water, let it be dried by placing it for some days rolled up in bibulous paper on a porous brick. This preparation should be kept in a well-stopped bottle.)—When valerianate of soda and sulphate of the sesquioxide of iron are mixed, double decomposition ensues, sulphate of soda is formed in solution, and valerianate of the sesquioxide of iron (*Ferri Valerianas, D.*) is precipitated.

According to Wittstein,² the formula for valerianate of iron is $3\text{Fe}^2\text{O}^3, 7\overline{\text{Va}}, 2\text{HO}$ or $7(\text{Fe}^2\text{O}^3, 3\overline{\text{Va}}) + 2(\text{Fe}^2\text{O}^3, 3\text{HO})$. The valerianate of iron precipitated in the cold is, therefore, a basic salt, the two equivalents of acid required to produce a neutral salt being replaced by two equivalents of water. If the valerianate be prepared with warm solutions, its composition, according to Rieckher,³ is $4\text{Fe}^2\text{O}^3, 9\overline{\text{Va}}$, without regarding the water, which he considers as hygroscopic.

Valerianate of iron, prepared according to the Dublin College, is a tile-red loose amorphous powder with a faint odour and taste of valerianic acid. When heated it first fuses, then evolves its acid, and is converted into sesquioxide of iron. At a temperature of 212° it gives out part of its acid. It is nearly insoluble in water; it does not intermix well with cold water, but repels it like lycopodium; and boiling water gradually extracts the acid from it. It dissolves in acids and in alcohol.

Various adulterations are said to be practised with it. Citrate and tartrate of iron, flavoured with a few drops of oil of valerian, have been extensively sold; but these substitutes are soluble in water and insoluble in spirit. Another substitute is in the form of a brown powder, soluble in water and in spirit. It smells of valerianic acid, but, on being decomposed with hydrochloric acid or sulphuric acid, yields no appreciable quantity of the oily product.⁴

The valerianate of iron which I have found in the most respectable shops in London, is only partially soluble in alcohol. It does not dissolve in water, but when gently heated with hydrochloric acid it dissolves and evolves a considerable quantity of valerianic acid which floats on the solution.

It is but little employed in medicine; nor is it probable that it will come into use, on account of its insolubility in water, its disagreeable odour, and its liability to adulteration. It possesses the medicinal qualities of the sesquioxide of iron and valerianic acid combined. It may be used in chlorosis or anæmia complicated with hysteria. The dose of it is from two to four grains in the form of pill.

8. QUINLE VALERIANAS, D.; *Valerianate of Quinia*.—(Take of Muriate of Quinia $\mathfrak{z}\text{viij}$; Valerianate of Soda gr. clxxiv; Distilled Water $\mathfrak{z}\text{xvj}$. Dissolve the valerianate of soda in two ounces, and the muriate of quinia in the remainder of the

¹ For further details and references, see Dierbach, *Die neuest. Entdeck. in d. Mat. Med.* Bd. iii. S. 486, 1845; Aschubrenner, *Die neueren Arzneien*, 1848; and Dunglison's *New Remedies*, 6th edit. p. 699, 1851.

² *Chemical Gazette*, vol. iii. p. 327, 1845. See also Wittstein's second analysis, *Pharm. Central-Blatt für 1848*, S. 732.

³ *Jahresbericht über d. Fortschritte in d. Pharm. in allen Land. in Jahre 1848*, S. 100; and Liebig and Kopp's *Annual Report*, vol. i. 1-17—48, p. 429.

⁴ *Pharmaceutical Journal*, vol. viii. pp. 577—579.

water, and, the temperature of each solution being raised to 120° , but not higher, let them be mixed, and let the mixture be set by for four-and-twenty hours, when the valerianate of quinia will have become a mass of silky acicular crystals. Let these be pressed between folds of blotting-paper, and dried without the application of artificial heat. Instead of weighing out seven drachms of muriate of quinia, and dissolving it in water, as is above prescribed, we may employ the solution of the muriate prepared from an ounce of the sulphate, as directed in the formula for *Quinia Murias*, such solution having been first evaporated to fourteen ounces. It may be observed here that, should it become necessary to evaporate a liquid containing valerianate of quinia, care must be taken that its temperature does not rise higher than 120° .—By the mutual action of the hydrochlorate or muriate of quinia and of the valerianate of soda, we obtain, by double decomposition, chloride of sodium and valerianate of quinia; the last-mentioned salt separates as a crystalline form. $Q^+HCl + NaO, \overline{Va} = NaCl + Q^+\overline{Va} + HO$.

Valerianate of quinia crystallizes in colourless rhomboidal tablets with a slight mother-of-pearl lustre, or in white opaque radiately grouped needles. $Q^+\overline{Va}$ 24110. It has a faint odour of valerianic acid and a bitter taste. It dissolves in 110 parts of cold, and in 40 parts of boiling water; in 6 parts of cold, and in equal parts of boiling alcohol, of sp. gr. 0.863; and likewise in ether. All the solutions are neutral.

There is also an amorphous resinous-looking valerianate of quinia obtained by concentrating the solution at a temperature above 122° ; and which is scarcely soluble in water. Its composition, according to Wittstein,¹ is $Q^+\overline{Va}$ 4110.

A spurious valerianate of quinia has been met with in commerce. It consists of the disulphate of quinia, to which a few drops of oil of valerian have been added to disguise it.² When added to water this yields a thin film of oil. It dissolves in about 30 parts of boiling water; and as the solution cools it deposits the well-known crystals of disulphate of quinia.

Valerianate of quinia was first prepared by Prince Louis Lucien Bonaparte,³ who tried it on some of the inhabitants of the marshy region, la Maremma, of Rome, and found that it produced less disorder of the nervous system than sulphate of quinia. It has also been employed by Devay,⁴ Castiglioni,⁵ and others, as an antiperiodic and an antispasmodic in intermittent and remittent diseases, especially intermittent neuralgia.

It may be administered in doses of from one to three or four grains, either in the form of pill, or in that of a mucilaginous mixture. If given in the latter form it must be remembered that it is readily decomposed by acids. Dissolved in sixty parts of oil it has been used as a liniment rubbed over the region of the spleen.

ORDER LVI. RUBIACEÆ, *Jussieu*.

CINCHONACEÆ and GALIACEÆ, *Lindley*.

CHARACTERS—Tube of the calyx adherent to the ovary; limb various, truncated or many-lobed, frequently regular; the lobes as many as those of the corolla, rarely intermixed with accessory teeth. Corolla gamopetalous, inserted into the top of the tube of the calyx; lobes usually 4 to 5, rarely 3 to 8; contorted or valvate in aestivation. Stamens as many as, and alternate with, the lobes of the corolla; more or less adnate to the tube of the corolla: anthers oval, bilocular, turned inwards. Ovary within the calyx to which it coheres, usually 2 or many-celled, rarely by abortion 1-celled, crowned with a fleshy urceolus, from which a single style arises. Stigma usually 2, distinct, or more or less coherent, rarely many, distinct or coherent. Fruit baccate, capsular, or drupaceous, 1 or many celled; the cells 1-, 2-, or many-seeded. Seeds in the 1-seeded cells attached to the apex, or usually at the base; in the many-seeded ones,

¹ *Chemical Gazette*, vol. iii. p. 326, 1845.

² *Pharm. Journ.* vol. viii. p. 577, 1849.

³ *Journ. de Chim. Méd.* t. viii. 2de sér. pp. 518—673, 1842; also *Pharmaceutical Journal*, vol. iv. p. 139, 1844.

⁴ *Pharm. Journ.* vol. iv. p. 430, 1844.

⁵ Quoted by Bouchardat, *Ann. de Thérapeutique*, pour 1845.

connected with a central placenta, usually horizontal; *albumen* horny or fleshy, large; *embryo* straight, or somewhat curved, in the midst of albumen; the *radicle* terete, turned to the hilum; the *cotyledons* foliaceous. (De Cand.)—*Trees, shrubs, or more rarely herbs.* *Leaves* simple, quite entire, opposite, or rarely verticillate, with stipules. *Flowers* arranged variously, rarely unisexual by abortion.

PROPERTIES.—The *roots* often abound in colouring matter, and hence are used in dyeing; as some of those belonging to the genera *Rubia*, *Gardenia*, *Hedyotis*, *Genipa*, *Galium*, *Asperula*, *Pali-caura*, *Oldenlandia*, &c. Many roots possess emetic properties, as those of *Cephaelis*, *Psychotria*, *Richardsonia*, *Spermacoe*, *Manettia*, *Chiococca*, &c.

The *barks* are often bitter, astringent, and somewhat aromatic; and are eminently distinguished for their tonic, febrifuge, and antiperiodic qualities, as those of *Cinchona*, *Exostema*, *Coutarea*, *Cosmibuena*, *Romija*, *Hymenodityon*, *Pinkneya*, &c.

The important use of the torrefied *albumen* of *Coffea arabica* is well known. It is probable that the albumen of other species possesses analogous properties; that of *Psychotria herbacea* has been used for similar purposes.

Sub-order I. COFFEACEÆ, Endl.

CHARACTERS—*Ovules* solitary, or very rarely 2 in each cell. *Fruit* with 1, very rarely 2, seeds in each cell.

227. *Rubia tinctorum*, Linn.—Dyer's Madder.

Sez. Syst. Tetrandria, Monogynia.

(Radix)

Ἱερὸς δάσων Hippocrates, de Morb. Mul. lib. 1, &c.; τὸ πικρόν ἱερὸδάσων, Dioscorides, lib. iii. cap. 160; *Rubia*, Pliny, lib. xix. cap. 17; and lib. xxiv. cap. 56. According to Beekmann (Hist. of Invent. and Discoveries, vol. iii. p. 275), it was called *Varantia* in the middle ages.—An herbaceous plant.—*Root* perennial, horizontal, long, crouching, reddish brown. *Stems* several, herbaceous, tetragonal, with hooked prickles. *Leaves* somewhat membranous. *Flowers* small, yellow. *Berries* dark purple. A native of the Levant and south of Europe; cultivated in France, Holland, &c. for the sake of the roots. The variety *β Iberica* is said to yield the best roots for tinctorial purposes.

Madder roots (*radix rubia tinctorum*) are long, cylindrical, about the thickness of a writing-quill, branched, externally deep reddish brown. They consist of a dark easily separable cortex, whose epidermis is thin, and of a ligneous medullium, which in the fresh state is yellow, but by drying becomes reddish. The odour of the root is feeble; the taste is bitter and astringent. The microscope discovers abundance of needle-shaped crystals (*raphides*) in the cells of the cortex of the root.

In commerce, madder occurs in two forms—in the entire root, and in the ground or pulverized state.

1. The name of *lizari* or *alizari*¹ is applied to the entire roots. The sort which is usually found in English commerce is the *Levant, Turkey, or Smyrna Madder*. It is cultivated in Greece and Turkey. Peter states that the best sort is that obtained from *Rubia peregrina* (which is by some regarded as a mere variety of *R. tinctorum*). In France, the *lizari* of *Avignon* is the kind usually found in the markets. *East India Madder* or *munjeet* is the produce of *Rubia Munjista*, Roxb.

2. Ground or prepared madder, called in France *garance*, is imported from Holland and France. *Dutch or Zealand madder* is of four kinds, viz. *crops* (the best), *ombro*, *gamene*, and *null* (the worst). *Alsatian madder* has replaced the Dutch sort in French manufactories. It is manufactured at Strasburgh, Hagenau, and Geisselbrunn. *Avignon madder* is the kind most generally used in France.²

Small quantities of *Spanish Madder* are imported.

The powdered madders are subject to adulteration. The substances employed for this purpose are mineral or vegetable. The mineral substances are brickdust, ochre, sand, and argillaceous earths. The vegetable substances are sawdust, bran, almond shells, &c. To determine the tinctorial value of commercial madders, Labillardière used a colorimeter. Others have determined it by dyeing; and some by the quantity of the colouring principle. (For details, the reader is referred to Girardin's paper before quoted.)

Madder root has been analyzed by Bucholz,³ by John,⁴ and by Kuhlmann.⁵

¹ The Turkish word *alizari* is derived from *ἄλίζα*, the modern Greek name for madder.

² Girardin, *Chemical Gazette*, vol. ii. p. 14, 1844.

³ Gmelin, *Handb. d. Chem.* ii. 1280.

⁴ *Ann. Chim. et Phys.* xxiv. 225, 1824.

⁵ *Ibid.*

<i>Bucholz.</i>		<i>Kuhlmann.</i>
Resinous red colouring matter	1.2	Red colouring matter.
Extractive ditto	39.0	Yellow ditto (<i>Xanthin</i>).
Reddish-brown substance, soluble in potash and hot alcohol	1.9	Mucilage.
A pungent extractive	0.6	Nitrogenous matter.
Gummy matter	9.0	Bitter substance.
Woody fibre	22.5	Gum.
Matter soluble in potash	4.6	Sugar.
Vegetable salts of lime, with colouring matter	1.8	Woody fibre.
Water	12.0	Vegetable acid.
Loss	7.4	Porous resin.
		Salts in the ashes.
Madder root	100.0	Madder root.

The *colouring matter* of madder has been the subject of repeated investigation. Decaisne¹ has shown that in the living state madder root contains only yellow colouring matter. This is held in solution, and resides not in any peculiar vessels or secretory apparatus, but in the cellular tissue and latex vessels. Nor is it confined to the root, for in the stem of full-grown plants, larger or smaller spots are here and there found, where the cells and spiral vessels are filled with it. As the root becomes older the yellow liquid becomes deeper coloured. By exposure to atmospheric oxygen this yellow liquid becomes red, cloudy, and granular; the granules appearing to be of a gummy-resinous nature, and partly soluble in alcohol.

Several chemists have investigated the nature of the colouring matter of madder; those which deserve to be especially mentioned are Robiquet and Colin,² Gaultier de Claubry and Persoz,³ Runge,⁴ Schunck,⁵ Debus,⁶ Strecker,⁷ and Rochleder.⁸ The result of their investigation has been the production of several colouring matters, which, if Decaisne's observations be correct, must be derived from a single principle.

Runge states that madder contains two colourless acids (termed respectively *madderic* and *rubiacic* acids) and five colouring matters, which he calls respectively *madder purple*, *madder red*, *madder orange*, *madder yellow* (the *xanthin* of Kuhlmann) and *madder brown*. Of these, however, the two red colouring matters (*madder purple* and *madder red*) alone require separate notice.

1. **ALIZARINE**, Robiquet and Colin; *Red colouring matter*, Claubry and Persoz; *Madder red*, Runge; *Licnic acid*, Debus. This occurs in two forms, the anhydrous and hydrated. *Anhydrous alizarine* ($C^{20}H^{16}O^6$) according to Strecker; $C^{60}H^{19}O^{19}$ according to Rochleder) has a red colour passing more or less into yellow. It fuses and sublimes in orange-coloured needles. It dissolves in boiling water, in alcohol, and in ether. The solutions are yellow. The slightest trace of alkali colours the aqueous solution red. It dissolves in alkaline solutions. The liquid obtained is, if dilute, violet coloured, but if concentrated, blue by reflected, and purple by transmitted light. It is insoluble in a cold solution of alum. It forms a red solution in hydrated sulphuric acid. *Hydrated alizarine* ($C^{20}H^{10}O^{10}$ or $C^{20}H^6O^6 + 4aq$) occurs in small scales having the appearance of mosaic gold.

2. **PURPURINE**, Robiquet and Colin; *Madder-purple*, Runge; *Orylizaric acid*, Debus. This differs from alizarine chiefly in its solubility in solution of alum; the resulting liquid has a fine bright red colour—by reflected light an orange colour. *Anhydrous purpurine* ($C^{18}H^6O^6$) is in the form of red acicular crystals. It dissolves more readily in warm water than alizarine; it is also soluble in alcohol, ether, concentrated sulphuric acid, and potash. Its aqueous, alcoholic, and potash solutions are red; by the colour of its potash solution it may be distinguished from alizarine. *Hydrated purpurine* ($C^{18}H^7O^7$ or $C^{18}H^6O^6 + 1aq$) is in the form of orange coloured crystals.

The influence of madder over the system is exceedingly slight. Its topical effect is scarcely obvious. Hume⁹ ascribed to it emmenagogue qualities. Others have declared it to be diuretic. Neither of these effects, however, were observed by Dr. Cullen.¹⁰ It may, perhaps, possess mild astringent and tonic properties.

But the most remarkable physiological effect of madder is that of colouring the bones of animals fed with it, red. This fact was noticed by Belcher;¹¹ though Beckmann¹² has adduced evidence to prove that some hints of it are to be found in the works of the ancients. This effect on the bones is produced more effectually, and in a much shorter time, in young than in old animals. In birds, the beak and claws become coloured. As the nerves, cartilages, aponeuroses,

¹ *Recherches Anatom. et Physiol. sur la Garance*, Bruxelles, 1837. Also, Meyen's *Report on the Progress of Vegetable Physiology during the year 1837*, translated by W. Francis, p. 49, Lond. 1839; and *Journal de Pharmacie*, t. xxiv. p. 421, 1838.

² *Ann. Chim. et Phys.* xxxiv. 225, 1827.

³ *Ibid.* xlviii. 69.

⁴ *Records of Science*, ii. 452; and iii. 44 and 135.

⁵ *Ann. der Chem. u. Pharm.* Bd. lxxvi. S. 174, 1848; also *Chemical Gazette*, vol. vi. p. 347, 1848.

⁶ *Chemical Gazette*, vol. vi. p. 437, 1848.

⁷ *Quarterly Journal of the Chemical Society of London*, vol. iii. p. 243, 1851; also Wolff and Strecker, in the *Chemical Gazette*, vol. viii. p. 329, 1850.

⁸ *Chemical Gazette*, Jan. 15, 1852.

⁹ *Clinical Experiments*, p. 422, 2d edit.

¹¹ *Phil. Trans.* vol. xxxix.

¹² *Mat. Med.*

¹² *Hist. of Invent. and Discov.* iii. 279.

tendons, and periosteum are not tinged, the effect is ascribed to the chemical affinity of the phosphate of lime for this colouring matter. Mr. Gibson¹ accounts for it as follows: The blood charged with the red particles imparts its superabundance of them to the phosphate as it circulates through the bones. But as soon as the blood is freed from the madder by excretion, the serum then attracts the colouring matter, and in a little time entirely abstracts it.

This hypothesis, has, however, been combated by Mr. Paget,² who asserts that the madder colours only those particles of phosphate of lime which are deposited during its use, and that it has no influence on the phosphate already existing in the bones before its administration, nor has the serum any chemical power to remove the colour from the phosphate once tinged. The coloured phosphate does indeed regain its whiteness after a time, when the madder is no longer exhibited; but this he ascribes to the "gradual decomposition of the madder, as reddened skeletons gradually lose their colour when exposed to air and light." As, however, living bones are not subjected to the same influence of air and light (powerful decolorizers), which the skeletons referred to are, the analogy does not hold good; and this part of Mr. Paget's hypothesis is, therefore, unsatisfactory.

Tiedemann and Gmelin³ could not detect the colouring matter of madder in the chyle: and the red tint of the serum prevented them from ascertaining its existence in the blood, though of this scarcely a doubt can exist, inasmuch as it has been found in the excretions (for example, urine, milk, and sweat).

It was formerly a favourite remedy in jaundice, in which disease Sydenham used it⁴ On account of its capability of tinging the bones red, it has been recommended in rickets and mollities ossium, on the supposition of its promoting the deposition of bone earth;⁵ but this notion appears to be groundless. Home⁶ employed it as an emmenagogue in uterine complaints.—The dose of it is ʒss to ʒij three or four times a day.

228. CEPHAËLIS IPECACUANHA, Richard.—THE TRUE IPECACUANHA.

Sez. Syst. Pentandria, Monogynia.

(Radix, L.—Root, E. D.)

HISTORY.—Ipecacuanha is first mentioned by Michael Tristram,⁷ who calls it *Ipecaya* or *Pigaya*. In 1684, it was described and figured by Piso.⁸ In 1686, it was celebrated in Paris as a remedy for dysentery. It appears that Jean-Adrian Helvetius (then a young man) attended with Afforty, a member of the faculty, a merchant, named Grenier, or Garnier, who, when he recovered from his illness, gave to his physician, as a testimony of his gratitude, some of this root, as a valuable remedy for dysentery. Afforty attached very little importance to it, but gave it to his pupil, Helvetius, who tried it, and thought he had found in it a specific against dysentery. Numerous placards were placed about the streets of Paris, announcing to the public the virtues of the new medicine, which Helvetius sold without discovering its nature. Luckily for him, some of the gentlemen of the court, and even the Dauphin, the son of the king (Louis XIV.), were at this time afflicted with dysentery. Being informed by his minister Colbert of the secret possessed by Helvetius, the king deputed his physician Aquin and his confessor Le P. de Chaise to arrange with Helvetius for the publication of the remedy. 1000 louis-d'or was the price which was paid, after some trials had been made with it at the Hôtel-Dieu, and which were crowned with the most brilliant success. Garnier now put in his claim for a part of the reward, saying that he, properly speaking, was the discoverer of the medicine; but the claim was not allowed. Subsequently, Helvetius obtained the first medical honours of France. He wrote a treatise, describing the use of ipecacuanha in diarrhœa and dysentery.⁹

Great confusion existed for a long time respecting the plant yielding Ipecacuanha. In 1800, Dr. Gomes returned from the Brazils, and brought with him the plant,

¹ *Manchester Memoirs*, v. 146, 2d ser.

² *Vers. u. d. Wegen auf welch Subst.* §. 7.

³ Sydenham's Works, by Dr. Peckey, 4th ed. p. 150, 1705.

⁴ *Con. Taper*

⁵ *Hist. Nat. Brasil.* 101.

⁶ *Lond. Med. Gaz.* Nov. 15, 1839.

⁷ *Journ. de Méd.* t. xxxvii. 1772.

⁸ Purchas, *Pilgrimes*, fol. vol. iv. 1311.

⁹ K. Sprengel, *Hist. de la Méd.* t. v. p. 468

on which he published a dissertation. In 1802, Brotero¹ described it under the name of *Callicocca Ipecacuanha*, which Richard² afterwards changed to *Cephaelis Ipecacuanha*.

BOTANY. Gen. Char.—Tube of the *calyx* obovate; limb very short, 5-toothed.

Fig. 321.



Cephaelis Ipecacuanha.

Corolla somewhat funnel-shaped; its lobes 5, small, rather obtuse. *Anthers* inclosed. *Stigma* bifid, usually exserted. *Berry* obovate-oblong, crowned with the remains of the *calyx*, 2-celled, 2-seeded. (De Cand.)

Sp. Char.—*Stem* ascending, at length erect, somewhat pubescent at the apex. *Leaves* oblong-ovate, rough above, finely pubescent beneath. *Stipules* cleft into setaceous segments. *Heads* terminal, erect, at length pendulous. *Bracts* 4, somewhat cordate. (De Cand.)

Root perennial, annulated, simple, or dividing into a few diverging branches, flexuous, from 4 to 6 inches long; when fresh, pale brown externally. *Stem* somewhat shrubby, 2 or 3 feet long, emitting runners.

Leaves rarely more than 4 or 6, placed at the end of the stem and branches; *petioles* pubescent, which are connected to each by the erect stipules. *Stipules* membranous at their base. *Peduncles* solitary, erect when in flower, reflexed when in fruit. *Head* semiglobose, 8- to 10-flowered. *Involucre* 1-leaved, spreading, deeply 4- to 6-parted; segments obovate. *Bracts* acute, pubescent; a single one to each flower. *Calyx* minute. *Corolla* white. *Stamens* 5. *Ovary* obovate; *style* filiform, white; *stigmas* linear, spreading. *Berry* soft, fleshy, violet-black. *Seeds* (nucules) pale, plane-convex; *albumen* horny.³

Hab—Brazil; in moist shady situations from 8° to 20° south latitude. Abundant in the valleys of the granitic mountains, which run (more or less distant from the sea) through the provinces of Rio Janeiro, Espírito Santo, and Bahia; also met with in Pernambuco. Humboldt and Bonpland found it on the St. Lucar mountains of New Grenada.

COLLECTION OF THE ROOTS.—The roots are gathered at all seasons of the year, though more frequently from January to March inclusive; and as no care is taken in the cultivation of the plant, it has become scarce around the principal towns. Those Brazilian farmers who reside in the neighbourhood of the plant carry on considerable commerce with it. The native Indians also are very assiduous in the collection of it. Those called by the Portuguese the Coroados, who live near the river Xipotó, in the province of Minas, as well as their neighbours, the Purí, are the greatest collectors of it. They sometimes leave their villages for two months at a time, fixing their habitations in those places in which this plant abounds. They cut the roots from the stems, dry them in the sun, and pack them in bundles of various sizes and forms.⁴

Ipecacuanha is imported into this country from Rio Janeiro, in bales, barrels, bags, and seroons.

DESCRIPTION.—The root of this plant is the *ipecacuanha* (*radix ipecacuanhæ*) of the shops. No other root is known in English commerce by this name. By continental writers it is denominated *annulated ipecacuanha* (*radix ipecacuanhæ annulatæ*), to distinguish it from the roots of *Psychotria emetica* and *Richardsonia scabra*; the first of which is termed striated ipecacuanha—the second, undulated ipecacuanha; both of which will be described hereafter.

The root of *Cephaelis Ipecacuanha* occurs in pieces of three or four inches long, and about the size of a small writing-quill; variously bent and contorted; simple or branched. It has a knotty appearance, in consequence of a number of deep

¹ *Trans. of the Linn. Soc.* vol. vi. p. 137.

² *Bull. de la Soc. de la Fac. de Méd.* 1815.

³ Condensed from Martius, *Spec. Mat. Med. Brasil.* p. v. 1824.

⁴ Martius, *op. cit.* p. 6.

circular fissures about a line in depth, and which extend inwardly to a central ligneous cord, so as to give the idea of a number of rings strung upon a thread (hence the name, *annulated*). These rings are unequal in size, both with respect to each other and to different parts of the same ring. This root has a resinous fracture. Its substance consists of two parts: *one* called the *cortical portion*, which is brittle and resinous, of a horny appearance, with a grayish or brownish-gray colour—sometimes whitish; and a *second*, called *meditullium*, and which consists of a thin, yellowish-white, woody, vascular cord, running through the centre of each piece. In 100 parts of good ipecacuanha there are about 80 of cortex and 20 of meditullium. Ipecacuanha root has an acrid, aromatic, somewhat bitter taste, and a slightly nauseous, but peculiar odour. The colour of the root varies somewhat, being brownish, reddish-brown, grayish-brown, or gray.

Fig. 322.



Brown Ipecacuanha Root.

a, Ringed portion. b, Portion of a root without rings.

Richard,¹ Mérat,² and Guibourt,³ admit three varieties of annulated ipecacuanha, whose principal distinction is the colour of the epidermis. The age of the root, the nature of the soil, and the mode of drying, are among the different circumstances producing these varieties. Sometimes they are met with in the same bale.

Var. a. BROWN ANNULATED IPECACUANHA, Richard; *Brown Ipecacuanha*, Lemery. (*Radix Ipecacuanhæ annulatæ fusca*.)—This is the best kind. The greater part of the ipecacuanha of commerce consists of this variety. Its epidermis is more or less deeply brown, sometimes even blackish; its fracture is gray or brownish, its powder is gray. The cortical portion has a horny appearance. The root which I have received from Professor Guibourt, as *blackish-gray ipecacuanha*, is somewhat less brown. It is the *gray or annulated ipecacuanha* of Mérat.

I have occasionally found in commerce a *brown non-annulated* variety of ipecacuanha (Fig. 322 b) imported in distinct bales. It consists of slender, cylindrical, often branched pieces, frequently several inches long, smooth, or slightly warty, but not annulated or moniliform, with a very thin cortex, and a woody meditullium of the usual size, or thicker. These pieces appear to be the subterraneous basis of the stems or runners, and the ends of the roots. Occasionally, pieces of the brown annulated ipecacuanha are found attached.

Var. β. RED ANNULATED IPECACUANHA, Richard.—This differs from the preceding by the lighter and reddish colour of its epidermis, by its less powerful odour, and by its want of aromatic taste. Sometimes it has, when broken, the same horny and semi-transparent quality of the brown ipecacuanha, but more frequently it is opaque, dull, and farinaceous; in which case it is generally less active. These differences probably depend on the nature of the soil on which the plant grew. The root which I have received from Professor Guibourt under the name of *reddish-gray annulated ipecacuanha*, is scarcely so red as the pieces which I have met with in English commerce. It is the *red-gray ipecacuanha* of Lemery and Mérat.

Var. γ. GRAY ANNULATED IPECACUANHA, Richard; *White-gray Ipecacuanha*, Mérat; *Greater Annulated Ipecacuanha*, Guibourt.—The colour of this variety is grayish-white. Professor Guibourt has met with it of a reddish gray colour. Gray ipecacuanha occurs in pieces of larger diameter than either of the foregoing kinds, with fewer, more irregular, and less prominent rings. Guibourt says that of late years considerable quantities of it have arrived unmixed with the ordinary sort, and he therefore thinks that it is a distinct kind coming from a different part of Brazil, and derived from another species of *Cephaelis*.

I have found, in English commerce, a gray ipecacuanha, whose roots were not longer than the brown variety, but whose rings were imperfectly developed.

¹ *Op. cit.*² *Dict. des Scienc. Méd.* t. xxvi.; and *Dict. Mat. Méd.* iii.³ *Hist. des Drog.* tom. iii. p. 79, 4me éd. 1850.

COMPOSITION.—The most important analyses of ipecacuanha are those of Pelletier,¹ Richard and Barruel,² Bucholz,³ and more recently by Willigk.⁴

PELLETIER'S ANALYSES.

	Brown Annulated Ipecacuanha, Red ditto.	
	Cortex.	Meditullium. Cortex.
Emetina	16	1.15 14
Odorous fatty matter	2	traces 2
Wax	6	0 0
Gum	10	5.00 16
Starch	42	20.00 18
Ligneous matter	20	66.60 48
Non-emetic extractive	0	2.45 0
Loss	4	4.80 2
Ipecacuanha	100	100.00 100

BUCHOLZ'S ANALYSIS.

Emetic extractive [emetina]	4.13
Soft resin	2.43
Wax	0.75
Gum	25.17
Starch	9.00
Woody fibre	10.80
Bitter extractive	10.12
Sugar	2.00
Extractive, gum, and starch, extracted by potash	34.80
Loss	0.50
Ipecacuanha	100.00

WILLIGK'S ANALYSIS.

Fat (small quantity).
Unpleasant smelling volatile oil.
Gum
Starch.
Pectin.
Emetina.
Ipecacuanha acid.
Woody fibre.

1. **ODOROUS FATTY MATTER.**—It is extracted from ipecacuanha by ether. It is of a brownish-yellow colour, soluble in alcohol and ether, to both of which it communicates a yellow colour. Its odour is very strong, and similar to that of the essential oil of the horseradish; it becomes insupportable when heat is applied, but is weak, and analogous to that of the ipecacuanha root, when diluted. The taste is acid; the specific gravity is greater than that of alcohol.

This fatty matter consists of two substances; 1st, a *very fugacious volatile substance*, which is the odorous principle of ipecacuanha root; 2dly, a *fixed fatty matter* (which some chemists have mistaken, when mixed with emetina, for resin), having little or no odour.

Notwithstanding its strong taste and odour, the fatty matter of this root does not seem to have any effect on the stomach. Given in large doses to animals it had no sensible operation. Caventou took six grains at one time, but experienced no marked effects therefrom. Pelletier and Magendie swallowed some grains of it, and experienced a disagreeable impression on the throat, but it was temporary only.

2. **EMETINA.**—When first discovered by Pelletier and Magendie, in 1817, it was termed *la matière vomitive*, or *emetine* (from *éméer*, *I vomit*).

Pure emetina is white (when not absolutely pure it has a grayish-yellow tinge), pulverulent, inodorous, with a slight bitter taste; fusible at 122° F.; very slightly soluble in cold, but much more so in hot water; very soluble in alcohol, but scarcely soluble in ether and oils. It dissolves in acids, the acidity of which it does not entirely destroy. The salts of emetina are slightly acid, and very crystallizable. They form gummy masses in some only of which are traces of crystallization occasionally found. Emetina restores the blue colour of litmus which has been reddened by an acid. I find that the yellowish-white emetina, sold in the shops under the name of pure emetina, is coloured red by nitric acid, the red colour being much deepened on the addition of ammonia. An alcoholic solution of iodine, added to an alcoholic solution of emetina, produces a reddish precipitate (*hydriodate of emetina*?). Tincture of galls copiously precipitates solutions of emetina (*tannate of emetina*). The effect of these reagents on emetina is similar to their effect on morphia; but from this last substance emetina is distinguished by the salts of iron, which produce no change of colour in it.

The following is the composition of emetina:—

	Atoms.	Eq. Wt.	Per Cent.	Dumas and Pelletier.
Carbon	35	210	65.42	64.57
Hydrogen	25	25	7.79	7.77
Nitrogen	1	14	4.36	4.30
Oxygen	9	72	22.43	22.39
Emetina	1	321	100.00	99.59

The following are stated by Magendie⁵ as the effects of *impure* emetina: From half a grain

¹ *Journ. de Pharm.* iii. 148.

² *Gmelin. Handb. de Chem.* ii. 1281.

³ *Formulaire*, 95.

⁴ *Ibid.* vi. 261.

⁵ *Pharmaceutical Journal*, vol. x. p. 605, 1851.

to two grains given to cats and dogs, caused at first vomiting, then sleep. In doses of from six to ten grains, vomiting, sleep, and death took place. Dissection showed inflammation of the pulmonary tissues and of the mucous membrane of the alimentary canal, from the cardia to the anus. The same effects (namely, vomiting, sleep, and death) were observed when impure emetina was dissolved in water, and injected into the jugular vein, into the pleura, into the anus, or into the muscular tissue. On man, a quarter of a grain excited nausea and vomiting; a grain and a half, or two grains, taken fasting, caused continued vomiting and decided disposition to sleep.

The effects of pure emetina are similar, but more energetic. In one case $\frac{1}{16}$ of a grain caused vomiting in a man eighty-five years of age: two grains are sufficient to kill a dog.

Emetina has been proposed as a remedial agent, as a substitute for ipecacuanha, all the advantages of which it is said to possess in a much smaller dose, and without the unpleasant taste and odour which the root is known to have. I confess, however, I think very little advantage is likely to be gained by the substitution. When we wish to give emetina in a liquid form, it may be readily dissolved in water by the aid of acetic or dilute sulphuric acid.

3. STARCH.—The cortical portion of the root abounds in starch, the grains of which are compound, and consist of particles which present more or less flattened faces, some being mullar-shaped, others dibedral or trihedral at one end.

4. IPECACUANHA ACID, $C^{14}H^{10}O^6$.—This acid was mistaken by Pelletier for gallic acid. It is reddish-brown, bitter, soluble in ether, alcohol, and water. It colours the persalts of iron-green, and acts as a reducing agent on the salts of silver and mercury. It absorbs oxygen from the air, and becomes darker coloured.

CHEMICAL CHARACTERISTICS.—A decoction of the root, filtered and allowed to cool, becomes, on the addition of a solution of free iodine blue, (*iodide of starch*). Tincture of nutgalls forms in the decoction, as well as in the tincture diluted with water, a grayish-white precipitate (*tannate of emetina*). Sesquichloride of iron communicates a greenish tint (*ipecacuanhate of iron*) to the decoction as well as to the diluted tincture. A solution of isinglass forms in the infusion, after twelve hours, a precipitate. Alcohol renders the decoction turbid (*gum*). Diacetate of lead forms with the tincture, and especially with the decoction, a precipitate (*colouring matter, gum, and oxide of lead*).

PHYSIOLOGICAL EFFECTS.—If the powder or dust of ipecacuanha be applied to the eyes or face, it acts as an irritant, and causes redness and swelling of these parts. Inhaled, it irritates the respiratory passages, and, in some persons, brings on difficulty of breathing, similar to an attack of spasmodic asthma.¹ Mr. Roberts, surgeon at Dudley, is affected in this way; and I have received from him the following account of his case: "If I remain in a room where the preparation of ipecacuanha is going on—for instance, making the pulv. ipecac. comp.—I am sure to have a regular attack of asthma. In a few seconds dyspnoea comes on in a violent degree, attended with wheezing and great weight and anxiety about the præcordia. The attack generally remains about an hour, but I obtain no relief until a copious expectoration takes place, which is invariably the case. After the attack is over, I suffer no farther inconvenience. I have always considered that the attack proceeds from the minute particles of the ipecacuanha floating in the atmosphere acting as an irritant on the mucous membrane of the trachea and bronchial tubes." In some cases, the mere odour of the root seems sufficient to excite difficulty of breathing, with a feeling of suffocation.

There is one case recorded of poisoning by the incautious inhalation of the dust of ipecacuanha, in the process of powdering it, by a druggist's assistant. It is mentioned by Dr. Priegher.² The patient, who was suffering from catarrh and cough, inhaled, during three hours, the dust from the root; in consequence of which, vomiting came on, followed by a tightness of the chest. An hour after this he complained of a sense of suffocation, and constriction of the trachea and throat; his appearance was pale and deathly. The physician who was called in bled him, and gave assafoetida and belladonna, with temporary relief; but in five hours a fresh attack came on, with the most imminent danger of suffocation. A strong decoction of uva-ursi, with the extract of rhatany, was administered with almost imme-

¹ Scott, *Phil. Trans.* for 1776, p. 168.

² *Rust's Mag.* B. xxxii. II. i. S. 182.

ciate relief, and in an hour his breathing was much freer. He was able to leave the house in two days, but suffered several days with difficulty of breathing.

When taken *in small and repeated doses*, ipecacuanha principally directs its influence to the secreting organs, especially those of the chest, whose activity it promotes. It specifically affects the bronchial membrane, in some morbid conditions of which it promotes expectoration, while in others, attended with a profuse secretion of phlegm, it exerts a beneficial influence, and often contributes to the restoration of the part to its normal condition. *In somewhat larger doses* it creates nausea, with its concomitant phenomena, depression, increased secretion of saliva and buccal mucus, &c. If a diaphoretic regimen be adopted, it exerts a powerfully relaxing influence over the skin. *In full medicinal doses* it occasions vomiting, followed by a tendency to sleep. Its operation as an emetic is exceedingly safe, since inflammation is not produced by it, even when an overdose has been swallowed.

The vomiting produced by ipecacuanha is not so violent as that induced by emetic tartar, neither is it so long continued, nor attended with such nausea and depression. Farthermore, ipecacuanha is less disposed to act on the bowels. The tonic and astringent qualities of the zincic compounds, as well as their want of diaphoretic power, distinguish these emetic substances from ipecacuanha. Squill (with which ipecacuanha agrees in its expectorant and emetic qualities) is distinguished by its greater acridity, and by its influence not being concentrated on the pulmonary organs, as is the case with ipecacuanha, which does not, therefore, possess that power of stimulating the urinary organs possessed by squill.

The most remarkable of the effects of ipecacuanha seem to be produced by the agency of the eighth pair of nerves. "How singular it is," says Dr. M. Hall,¹ "that ipecacuanha taken into the bronchia should excite asthma, and taken into the stomach should induce another affection of the respiratory system, vomiting." Sundelin² ascribes the red condition of the bronchial membrane, and the congestion of the lungs of animals killed by emetine, not to the specific stimulus exerted by this substance over the pulmonary mucous membrane, but to an exhausting stimulus over the eighth pair of nerves, by which a condition similar to suffocative catarrh (*Steckflus*) is brought on; for he has observed the same appearances in the bodies of persons who have died of this disease, where there was certainly no inflammatory condition of the bronchial membrane, but a paralytic condition of its small bloodvessels.

USES.—Ipecacuanha is employed in full doses as an emetic, or in smaller doses as an expectorant and nauseant.

1. *In full doses, as an emetic.*—The mildness of its operation adapts ipecacuanha for the use of delicate and debilitated persons, where our object is merely to evacuate the contents of the stomach. Thus, it is well fitted for the disorders of children requiring the use of emetics (as when the stomach is overloaded with food in whooping-cough, croup, &c.), on account of the mildness and certainty of its action. It is also exceedingly useful for adults (especially delicate females); thus, in gastric disorders, to evacuate undigested acrid matters from the stomach—to promote the passage of biliary calculi—as a counter-irritant at the commencement of fevers—in many inflammatory diseases (as acute mucous catarrh, cynanche, hernia humoralis, and ophthalmia)—in asthma—and as an evacuant in cases of narcotic poisoning. When the indication is to excite gentle vomiting in very weak and debilitated frames, Dr. Pyc³ has shown that it may be effected frequently with the utmost ease and safety by ipecacuanha in doses of from two to four grains. Dr. Cullen⁴ has expressed some doubt with respect to the correctness of this statement; but it is well known that ten grains of Dover's powder (containing one grain of ipecacuanha) not unfrequently cause vomiting.

The mildness of its operation is not the only ground for preferring ipecacuanha to other emetic substances. Its specific power over the pulmonary organs and the

¹ *Lectures in the Lancet*, for April 21, 1838.

² *Med. Observ. and Inq.* vol. i. 240.

³ *Handb. d. sp. Heilmittel* ii. 5

⁴ *Mat. Med.* ii. 474.

stomach leads us to prefer it in maladies of these parts, in which vomiting is likely to be beneficial; especially in those affections in which the nerves appear to be more than ordinarily involved, as spasmodic asthma and whooping-cough. In the first of these complaints, Dr. Akenside¹ has shown that it proves equally serviceable even when it fails to occasion vomiting, and merely produces nausea. He gave a scruple, in the paroxysm, to create vomiting, and, in the interval, five grains every morning, or ten grains every morning. Dr. Wright² recommends gentle emetics of ipecacuanha at the commencement of the treatment of dysentery.

2. *In small doses, as a nauseant, antispasmodic, diaphoretic, and expectorant.*—When given in doses insufficient to occasion vomiting, ipecacuanha is serviceable in several classes of complaints, especially those of the chest and alimentary canal.

a. *In affections of the respiratory organs.*—Nauseating doses of ipecacuanha are used with considerable advantage in acute cases of *mucous catarrh*. They favour expectoration and relaxation of the cutaneous vessels. In milder and more chronic forms, smaller doses, which do not occasion nausea, will be sufficient. In children, who bear vomiting much better than adults, full nauseating or even emetic doses are to be preferred.

“When a child becomes hoarse, and begins to cough,” says Dr. Cheyne,³ “let every kind of stimulating food be withdrawn; let him be confined to an apartment of agreeable warmth; have a tepid bath; and take a drachm of the following mixture every hour, or every two hours if it produces sickness: *R. Vini Ipecacuanhæ ℥ij; Syrupi Tolut. ℥v; Mucil. Acaciæ ℥j. Mix.*; and all danger will probably be averted; whereas, if no change be made in the quality of the food, and if he be sent into the open air, he will probably undergo an attack of bronchitis or croup.”

In *whooping-cough*, in which disease considerable benefit is obtained by the use of emetic substances, ipecacuanha is frequently administered with advantage. After giving it to create vomiting, it should be administered in nauseating doses. In *asthma*, benefit is obtained by it, not only when given so as to occasion nausea and vomiting, as above noticed, but also in small and repeated doses. In both this and the preceding disease, the benefit procured by the use of ipecacuanha arises, not from the mere expectorating and nauseating operation alone of this remedy, but from its influence otherwise over the eighth pair of nerves. In *bronchial hemorrhage* (*hæmoptysis*) the efficacy of ipecacuanha has been greatly commended. A. N. Aasheim,⁴ a Danish physician, gave it in doses of one-fourth of a grain every three hours during the day, and every four hours during the night. In this way it excites nausea, and sometimes even vomiting. It checks the hemorrhage, alleviates the cough, and relaxes the skin.

β. *In affections of the alimentary canal.*—In *indigestion*, Daubenton⁵ gave it in doses just sufficient to excite a slight sensation of vermicular motion of the stomach, without carrying it to the point of nausea. Eberle⁶ tried it, in his own case, with evident advantage. An anti-emetic quality has been assigned to it by Schönheider.⁷ In *dysentery*, ipecacuanha has gained no trifling celebrity, whence its name of *radix antidysenterica*. In severe forms of the disease no one, I suspect, now would think of relying on it as his principal remedy; but, as an auxiliary, its efficacy is not to be denied. The advocates for its use, however, are not agreed as to the best mode of using it. Sir George Baker⁸ and Dr. Cullen⁹ consider it to be of most benefit where it acts as a purgative; but this can scarcely be its *modus medendi*. From my own observations of its use in the milder forms of dysentery met with in this country, I am disposed to ascribe its efficacy in part to its diaphoretic powers, since I have always seen it promoted by conjoining a diaphoretic regimen. But its tendency to produce an antiperistaltic movement of the intestines doubtless contributes

¹ *Med. Trans.* i. 93.

² *Cyclop. of Pract. Med.* art. *Croup*, vol. i. p. 496.

³ *Vixanthampt rad. ipec.* in *Acta Reg. Soc. Med. Hafn.* i. 170.

⁴ *Treat. of the Mat. Med.* i. 44, 2d edit.

⁵ *De dysenteria*, 1761.

⁶ *Memoirs of*, pp. 379 and 397.

⁷ *Mém. sur les Indigest.* 1798.

⁸ *Acta Reg. Soc. Med. Hafn.* ii. 139.

⁹ *Mat. Med.* ii. 477.

to its antidiysenteric property. It is best given, I think, in conjunction with opium. Its determination to the skin should be promoted by warm clothing, and the free use of mild, tepid aliments. Mr. Twining¹ gave ipecacuanha in large doses (grs. vj), with extract of gentian, without causing vomiting. Mr. Playfair² recommends from half a drachm to a drachm of ipecacuanha, with from thirty to sixty drops of laudanum, to be given at the commencement of the disease.

γ. *In various other maladies.*—As a sudorific, ipecacuanha is given in combination with opium (see *Pulvis Ipecacuanhæ compositus*) in various diseases. On the continent it is esteemed as an antispasmodic. In uterine hemorrhage, also, it has been employed. In chronic visceral enlargements it has been administered as a resolvent.

ADMINISTRATION.—The usual dose of ipecacuanha, in powder, as an emetic, is grs. xv. But a much smaller quantity (for example, six, or four, or even two grains) will frequently suffice, as I have before mentioned. But a scruple, or half a drachm, may be taken with perfect safety. A commonly-used emetic consists of one grain of emetic tartar, and ten or fifteen grains of ipecacuanha. For infants, half a grain or a grain of this root is usually sufficient to occasion vomiting. In all cases the operation of the remedy should be assisted by diluents. As a *nauseant*, the dose is from one to three grains. As an *expectorant* and *sudorific*, the dose should not exceed one grain; for infants, one-quarter or one-eighth of a grain. *Ipecacuanha lozenges* contain usually from a quarter to half a grain of the powder, and may be used in catarrhal affections to promote expectoration. *Infusion of ipecacuanha* (prepared by digesting ℥ij of the coarsely-powdered root in f℥vj of boiling water) may be used as an emetic, in cases of narcotic poisoning, in doses of f℥j to f℥ij.

1. VINUM IPECACUANHÆ, L. E. D. [U. S.]; *Wine of Ipecacuanha*.—(Ipecacuanha, bruised, ℥ijss; Sherry Wine Oij. Macerate for seven [fourteen, D.] days, and strain.)—[The U. S. Pharm. directs Ipecacuanha, bruised, ℥ij; White Wine Oij. Macerate for fourteen days, with occasional agitation; then express and filter through paper, or by displacement.]—According to Dr. A. T. Thomson, a pint (i. e. f℥xvj) of wine takes up 100 grains of the soluble matter of ipecacuanha. This preparation is diaphoretic, expectorant, and emetic—Dose for an adult, as a diaphoretic and expectorant, ℥x to ℥xl; as an emetic, f℥ij to f℥iv. On account of the mildness of its operation, it is given, as an emetic, to children; the dose is from ℥xx to f℥j, according to the age of the child. It is also exceedingly useful as an expectorant in the diseases of infants; dose from ℥v to ℥x.

2. SYRUPUS IPECACUANHÆ, E. [U. S.]; *Syrup of Ipecacuanha*.—(Ipecacuanha, in coarse powder, ℥iv; Rectified Spirit Oj; Proof Spirit and Water, of each, f℥xiv; Syrup Ovj. Digest the ipecacuanha in four fluidounces of the rectified spirit, at a gentle heat, for twenty-four hours; strain and squeeze the liquor, and filter. Repeat this process with the residuum and proof spirit, and again with the water. Unite the fluids, and distil off the spirit till the residuum amount to twelve ounces; add to the residuum five fluidounces of rectified spirit, and then the syrup.)—[The U. S. Pharm. directs Ipecacuanha in coarse powder ℥j; Diluted Alcohol Oj; Syrup Oij. Macerate the ipecacuanha in the alcohol for fourteen days and filter. Evaporate the filtered liquor to f℥ij, and again filter; then mix it with the syrup and evaporate by means of the water-bath to the proper consistence, or prepare the alcoholic solution by displacement, and proceed as after directed.]—A syrup of ipecacuanha is a very useful preparation for children; but some difficulties attend its preparation. An aqueous decoction of this root contains so much starch that it can scarcely be filtered. Even the infusion filters slowly, is always turbid, and yields a syrup which does not keep well. Hence MM. Guibourt and Henry³ introduced a process,

¹ *Trans. of the Med. and Phys. Soc. of Calcutta*, vol. iv. p. 170.

² *Edinb. Med. and Surg. Journal*, vol. ix. p. 18.

³ *Pharm. Raison*. i. 502, 2de édit.

of which that of the Edinburgh Pharmacopœia is a modification (improvement?). They prepared an alcoholic extract, which is dissolved in water and mixed with concentrated syrup. About two fluid-scruples of the Edinburgh preparation contain the strength of one grain of ipecacuanha; hence the dose of it, as an *emetic*, for infants, will be half a teaspoonful; for adults, $\text{f}\overline{\text{3}}\text{j}$ or $\text{f}\overline{\text{3}}\text{iss}$. As an *expectorant*, the dose is $\text{f}\overline{\text{3}}\text{j}$ to $\text{f}\overline{\text{3}}\text{ij}$.

3. PULVIS IPECACUANHÆ COMPOSITUS, L. E. D.; *Compound powder of Ipecacuanha*; *Dover's Powder*; *Pulvis Doveri*, offic. (*Pulvis Ipecacuanha et Opii*, U. S.)—(Ipecacuanha, powdered, Hard Opium, powdered, of each $\overline{\text{3}}\text{j}$; Sulphate of Potash, powdered, $\overline{\text{3}}\text{j}$. Mix them. The proportions used by all the British Colleges are the same.)—This preparation is an imitation (though not a very exact one) of a formula given by Dover;¹ whence it is commonly known in the shops as *Dover's Powder*. The following is Dr. Dover's recipe:—

"Take opium $\overline{\text{3}}\text{j}$; saltpetre, tartar vitriolated, of each $\overline{\text{3}}\text{iv}$; ipecacuanha $\overline{\text{3}}\text{j}$; liquorice $\overline{\text{3}}\text{j}$. Put the saltpetre and tartar into a redhot mortar, stirring them with a spoon until they have done flaming. Then powder them very fine. After that, slice in your opium; grind these to a powder, and then mix the other powders with them. Dose, from 40 to 60 or 70 grains in a glass of white wine posset, going to bed. Covering up warm, and drinking a quart or three pints of the posset drink while sweating."

The compound powder of ipecacuanha is one of our most certain, powerful, and valuable sudorifics. The sulphate of potash is intended to serve the double purpose of promoting the sudorific operation of the other ingredients, and of minutely dividing, by the hardness of its particles, the opium and ipecacuanha. The nitrate of potash also employed by Dr. Dover probably contributed still further to the sudorific effect of the powder. The opium and ipecacuanha, combined, enjoy great sudorific properties not possessed by either of these substances individually. I am inclined, however, to ascribe the greater part of the activity of the compound to the opium, which, it is well known, strongly determines to the cutaneous surface (see OPIUM), and often produces pricking or itching of the skin; and, when assisted by the copious use of warm aqueous diluents, operates as a sudorific. This effect, however, is greatly promoted by the ipecacuanha, which has a relaxing influence over the cutaneous vessels. The use of the posset, enjoined by Dr. Dover, is an important part of the sudorific plan. The contra-indications for the use of compound powder of ipecacuanha are an irritable condition of the stomach (when this preparation is apt to occasion sickness) and cerebral disorder. Thus, in fever, a dry furred tongue, and a dry skin, with much disorder of the cerebro-spinal functions, it, like other opiates, is calculated to prove injurious. In such cases, the antimonial sudorifics may be resorted to. But when the tongue is moist, the skin, if not damp, at least soft—and the functions of the brain not much involved, it will probably operate beneficially. In slight colds, catarrhs, and rheumatic pains, it often proves most effectual. In various inflammatory affections, when the febrile excitement does not run too high, and when the brain is undisturbed, it may be used with good effect. In acute rheumatism it is occasionally highly serviceable; in diarrhœa and dysentery also. In hemorrhages from internal organs, as the uterus, it is useful on the principle of revulsion or counter-irritation, by its power of determining to the skin. The dose of this preparation is usually from grs. v to grs. x, given in currant jelly or gruel, or made into a pill (see *Pilulæ Ipecacuanhæ et Opii*), or administered in a common saline draught. Where the stomach is irritable, I have frequently seen five grains cause sickness. On the other hand, in some cases where a powerful sudorific is required, and the head quite free, grs. xv or even $\overline{\text{3}}\text{j}$, of this powder are not unfrequently given.

4. PILULÆ IPECACUANHÆ CUM SCILLA, L.; *Pilulæ Ipecacuanhæ Compositæ*, Ph. Lond. 1836; *Pills of Ipecacuanha and Squills*.—(Compound powder of Ipecacuanha $\overline{\text{3}}\text{ij}$; Squill, fresh-dried, in powder, Ammoniacum, of each $\overline{\text{3}}\text{j}$; Treacle, as

¹ *The Ancient Physician's Legacy to his Country*, p. 14, 1733.

much as may be sufficient. Beat them together until incorporated.)—Narcotic and sudorific. Employed in chronic catarrh.—Dose, gr. v to gr. x.

5. *PILULÆ IPECACUANHÆ ET OPII*, E.; *Pills of Ipecacuanha and Opium*.—(Powder of Ipecacuanha and opium, *three parts*; Conserve of Red Roses, *one part*. Beat them into a proper mass, which is to be divided into four-grain pills.)—The properties of this are the same as those of *Pulvis Ipecacuanhæ compositus*.—Dose, one to three pills.

6. *TROCHISCI MORPHÆ ET IPECACUANHÆ*. (See *Morphia*.)

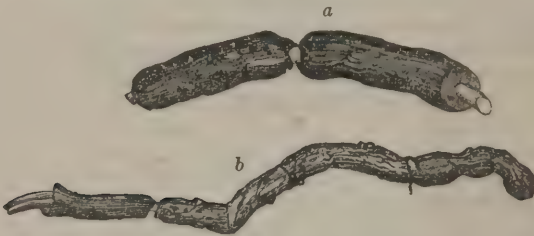
229. *Psychotria emetica*, Mutis.—*Striated Ipecacuanha*.

Sez. Syst. Pentandria, Monogynia.

(Radix.)

Ronabea emetica, Richard.—A small perennial plant, which grows in Peru and New Grenada and on the banks of the Magdalena. Its roots constitute the *striated ipecacuanha* (*radix ipecacuanhæ striatæ*) of Richard, Guibourt, and Mérat; the *black* or *Peruvian ipecacuanha* (*radix ipecacuanhæ nigræ vel peruviana*) of some other authors. They are neither annulated nor undulated,

Fig. 323.



Striated Ipecacuanha (Roots of *Psychotria emetica*).

a. An old root with a well-marked intersection. b. Contorted root.

but longitudinally striated. They have deep circular intersections at various distances, giving them the appearance of being articulated; and, when slight force is used, they fracture at these parts. As met with in commerce, they have externally a blackish-gray colour, with a brownish tinge; but when fresh they are said to be dirty reddish gray. Their fracture is resinous; the medullium, or central ligneous cord, is yellowish, and perforated by numerous holes, which are very visible by a magnifier; the cortical portion is softish, easily separable, and of a grayish-black colour, becoming much deeper when moistened. Its powder is deep gray. According to the analysis of Pelletier,¹ this root consists of—*emetina* 9, *fatty matter* 12, *gallic acid* a trace, *gum*, *starch*, and *ligneous matter* 79. In its medicinal qualities it resembles the annulated or true ipecacuanha, than which it is somewhat weaker; but it is not met with in English commerce.

230. *Richardsonia scabra*, De Cand.—*Undulated Ipecacuanha*.

Sez. Syst. Hexandria, Monogynia.

(Radix.)

Richardsonia pilosa, Ruiz et Pavon; *Richardia brasiliensis*, B. A. Gomes.—A perennial plant; a native of the Brazils, New Granada, Peru, Vera Cruz, &c. Its root is the *undulated ipecacuanha* (*radix ipecacuanhæ undulatæ*) of Guibourt; the *amylaceous* or *white ipecacuanha* (*radix ipecacuanhæ farinosæ seu amylacæ*) of Mérat. It has a jointed appearance, from constrictions which are remote from each other. It is about the same size as that of the annulated species; is tortuous, attenuated at the extremities; externally of a grayish-white colour, becoming brownish by age. It presents no rings properly so called, but is marked by semicircular grooves. It consists, like the annulated species, of a thin yellowish medullium, and a cortical portion.

The fracture of the root is not at all resinous, but farinaceous, and of a dull-white colour; the fractured surface presenting, when examined by a magnifier, numerous shining pearly, proba-

¹ *Journ. de Pharm.* t. vi. p. 265, 1820.

Fig. 324.

Undulated *Ipecacuanha* Root.a. Root of *Richardsonia scabra*. b. Root of a *Richardsonia*.

bly amylaceous spots. The odour is musty. The composition of it, according to Pelletier,¹ is emetina 6, fatty matter 2, starch and ligneous matter (very little of the latter) 92. In its medicinal qualities it agrees with the annulated *ipecacuanha*, than which it is somewhat weaker. This, like the preceding sort of *ipecacuanha*, is not in use in England.

231. *Coffea Arabica*, Linn.—The Coffee Tree.

Sex. Syst. Pentandria, Monogynia.
(Semina.)

According to manuscripts contained in the Bibliothèque Royale, at Paris, coffee was in use in Persia in the year A. D. 875.² It was first introduced into England in 1652.³ The coffee plant is a native of Arabia Felix and Ethiopia, but is extensively cultivated in Asia and America. It is an evergreen shrub, from 15 to 20 feet high, with oblong-ovate, acuminate, smooth leaves, a 5-toothed calyx, a white tubular corolla, with a 5-parted spreading limb, 5 stamens, 1 pistil with a bifid style, and an oval, succulent, blackish-red or purplish 2-seeded berry. The seeds are inclosed in a membranous endocarp (the parchment-like putamen of some botanists), and are convex on one side, and flat with a longitudinal groove on the other. They consist of a horny, yellow, bluish or greenish convoluted albumen, at the one end of which is the embryo, with its cordiform cotyledons; the position of the radicle being indicated by the micropyl. The dried fruits or berries are rarely imported. In 1839, there was an importation of them into London from Demerara. Occasionally, the seeds contained in their endocarp (coffee in the husk) are met with in commerce. The raw coffee of the shops consists of the seeds (in commerce frequently, but erroneously, called "berries") deprived of their endocarp and in part of their testa. Portions of the testa are, however, found on the convex surface, and lining the groove on the flat surface. The varieties of raw coffee are distinguished in commerce according to their places of growth; but considered with reference to their physical properties, they are characterized by colour (yellow, bluish, or greenish) and size (the smallest seeds are about three lines long and two broad, the largest five lines long and two lines and a half broad). Arabian or Mocha Coffee is small, and dark yellow. Java and East India (Malabar) kinds are larger, and paler yellow. The Ceylon is more analogous to the West India kinds (Jamaica, Berbice, Demerara, Dominica, Barbadoes, &c.), which, as well as the Brazilian, have a bluish or greenish-gray tint. The structure of the raw coffee seed has been fully described and depicted by Dr. Hassall.⁴ The testa or investing membrane of the seed is made up of very elongated cells more or less tapering at one or both extremities, with oblique markings on their surface. In the act of roasting it separates from the seed, and is commonly termed by the roasters "flights" or "the fibre." The great mass of the seed (vulgarly and improperly called "berry") is made up of the perisperm or albumen, which is composed of angular cells, containing each one or more drops of aromatic volatile oil. The cells of the embryo are smaller than those of the albumen.

Coffee has been chemically examined by Hermann, Cadet, Schrader, Robiquet and Boutron, Rochleder, Payen, and others. Schrader made a comparative examination of raw and roasted Martinique coffee, and obtained the following results:—

Peculiar coffee principle	17.59	Coffee principle	12.50
Gummy and mucilaginous extract	3.64	Extractive	4.80
Extractive	0.62	Gum and mucilage	10.42
Resin	0.41	Oil and resin	2.08
Fatty oil	0.52	Solid residue	68.75
Solid residue	66.66	Loss	1.45
Loss (water?)	10.57		
Raw coffee	100.00	Roasted coffee	100.00

¹ *Dict. des Drogues*, t. iii. p. 265, 1828.

² *Phil. Trans.* vol. xxi. p. 311, 1699.

³ Mérat and De Lens, *Dict. Mat. Méd.* tom ii. p. 345.

⁴ *Lancet*, Jan. 4, 1851.

The latest quantitative analysis of coffee is that of Payen,¹ who gives the following as the approximative composition of it:—

Cellulose	34.000
Water (hygroscopic)	12.000
Fatty substances	10 to 13.000
Glucose, dextrine, and undetermined vegetable acid	15.500
Legumin, casein (glutin)?	10.000
Chlorogenate [caffeate] of potash and caffein	3.5 to 5.000
Nitrogenous substance	3.000
Free caffein	0.800
Concrete essential oil	0.001
Aromatic fluid essential oil	0.002
Mineral substances	6.697
	<hr/> 100.000

A decoction of raw coffee is coloured green by the persalts of iron. Raw coffee macerated in water undergoes fermentation, and evolves carbonic acid and sulphuretted hydrogen gases. This fermentation is probably due to the decomposition of an albuminous and sulphurous substance contained in coffee. Alcohol extracts from raw coffee a double salt, the *caffate* (called by Payen the chlorogenate) of *potash and caffein*. Berzelius states that caffeic acid ($C^{14}H^8O^7$ according to Payen) bears the same relation to the tannin (*caffetannic acid*) of unroasted coffee, that gallic acid bears to the tannin of nutgalls. The *aromatic volatile oils* of raw coffee are tenaciously retained by the *fatty oil*; they undergo alteration of properties by the operation of roasting. *Caffein* ($C^8H^2N^2O^2$) is a weak alkaloid, white, crystallizable in long silky needles, fusible, volatile, and soluble in water, alcohol, and ether. Its aqueous solution is precipitated by tannic acid. It is identical with *theine* extracted from China tea, and from Paraguay tea (*Ilex paraguayensis*), and with *guaranin* obtained from guarana (*Paullinia sorbilis*).

The chemical changes effected in coffee by roasting, require farther investigation. The cells of the seeds are charred and rendered friable, but they retain their characteristic shape. The volatile oil, however, is no longer visible in them in the form of drops, but appears to have been partially dissipated and partially diffused through the charred cells. The two most interesting products of the torrefaction are a *brown bitter principle*, and a *brown aromatic oil* called *caffeone*.² Both of these are products of the decomposition of that part of raw coffee which is soluble in water; for if raw coffee be first exhausted by water, and afterwards roasted, it is then found to yield to boiling water neither the bitter substance nor the aromatic principle. Caffeone is slightly soluble in boiling water, and may be extracted from the distilled water of roasted coffee by means of ether. If coffee be over-roasted, either by employing too high a temperature, or by carrying on the process too long, its flavour is greatly impaired.³

The ground coffee sold by grocers is in general largely adulterated.⁴ The usual agent employed by the grocers for this purpose is roasted chicory; but as the chicory roasters frequently adulterate this article, as I have already stated (see *ante*, p. 608), it follows that besides chicory, properly so called, various other foreign matters may frequently be detected in ground coffee. The following are the readiest modes of proceeding in order to detect the fraud:—

1. Place a portion of the suspected coffee gently upon the surface of water in a glass. If it be genuine it becomes very slowly moistened by the water, even when we stir them up together, and in consequence floats on the surface, and communicates scarcely any colour to the liquid. This arises from the coffee being impregnated with volatile oil, which exercises a repulsive influence on the water.

Chicory, on the other hand, readily absorbs and mixes with the water, to which it speedily communicates a deep reddish-brown tint, and sinks to the bottom of the liquid.

Roasted corn and roasted pulse (peas, beans, and lupines) behave, in relation to water, like roasted chicory.

2. An infusion or decoction of pure roasted coffee, when cold, becomes, on the addition of a solution of iodine, of a deeper reddish-brown tint.

A similar effect is produced on the addition of a solution of iodine to an infusion or decoction of pure roasted chicory.

But if roasted corn, roasted pulse (peas or beans), or potatoes be present, the iodine communicates a deep-blue, blackish-blue, or purplish-red colour. If the starch of these adulterating ingredients be but little altered by roasting, the resulting colour, on the addition of iodine, will be blue; but if the starch be converted into dextrine, the colour caused by iodine will be purplish-red. The presence of much chicory, however, obscures the effect of this test.

3. If a decoction of genuine roasted coffee be submitted to Trommer's test (see *ante*, p. 150), it gives no indication of the presence of glucose (grape sugar). By this test, burnt sugar or

¹ *Chemical Gazette*, vol. v. p. 34, 1847.

² Boutron and Fremy, quoted by Pelouze and Fremy, *Cours de Chimie Générale*, t. iii. p. 250, 1850.

³ For farther details, see Payen's paper before quoted.

⁴ See a paper by the author, in the *Pharmaceutical Journal*, vol. iv. p. 85, 1844; also Dr. Hassall's reports, in the *Lancet* for Jan. 4, April 26, May 3, and Nov. 1, 1851.

partially charred saccharine matter (sold under the name of "refining powder" for adulterating coffee), as well as glucose derived from other sources (as the conversion of amylaceous matters), may be detected.

4. The most important aid in detecting the presence, and in determining the nature, of adulterations of coffee, is the microscope. The presence of chicory may be detected by the size, form, and ready separation of the cells of the cellular tissue, and by the presence and abundance of the pitted tissue (dotted ducts) and vascular tissue or spiral vessels (see *ante*, p. 608). Roasted corn, pulse, potatoes, and other amylaceous substances, may be detected and identified by the characters (size, shape, and markings) of the starch grains. (For farther details, see Dr. Haasall's observations contained in the *Lancet*.)

Raw coffee must be slightly nutritious, on account of the gum and other nutritive principles which it contains. Rasori employed it, like powdered bark, in intermittent fever; and Grindel used it, in other cases, also as a substitute for cinchona. By roasting, its nutritive principles are (for the most part) destroyed, while the empyreumatic matters developed communicate a stimulant influence with respect to the nervous system.

Roasted coffee possesses powerfully anti-soporific properties; hence its use as a drink by those who desire nocturnal study, and as an antidote to counteract the effects of opium and other narcotics, and to relieve intoxication. In those unaccustomed to its use, it is apt to occasion thirst and constipation. On some persons it acts as a slight purgative. It is occasionally useful in relieving headache, especially the form called nervous. It has also been employed as a febrifuge, in intermittents; as a stomachic, in some forms of dyspepsia; and as a stimulant to the cerebro-spinal system, in some nervous disorders. Floyer, Dr. Percival, and others, have used it in spasmodic asthma; and Laennec¹ says, "I have myself seen several cases in which coffee was really useful." The immoderate use of coffee is said to produce nervous symptoms; such as anxiety, tremor, disordered vision, palpitation, and feverishness.

The action of caffeine requires farther investigation. Mulder gave a grain of it to a rabbit; the animal ate but little the next day, and aborted the day after. Liebig has suggested that it probably contributes to the formation of taurine, the nitrogenized constituent of bile. According to Lehmann,² caffeine, in doses of from 2 to 10 grains, causes violent excitement of the vascular and nervous systems, palpitations of the heart, extraordinary frequency, irregularity, and often intermission of pulse, oppression of the chest, pains in the head, confusion of the senses, singing in the ears, scintillations before the eyes, sleeplessness, erections, and delirium. In all cases an augmentation was found in the amount of urea secreted.

232. CINCHONA, Weddell.

C. Callaya, *Condaminea*, et species inserta, *L.*—*C. Condaminea*, *micrantha*, and other undetermined species, *E. D.*

Sex. Syst. Pentandria, Monogynia.

(*Cortex, L.*—The Bark, *E. D.*)

HISTORY.—The precise period and manner of the discovery of the therapeutic power of cinchona are enveloped in mystery. Some writers (*e. g.* Geoffroy,³ Ruiz,⁴ and Joseph de Jussieu⁵) believe that the Indians were acquainted with it long before the arrival of the Spaniards; whereas others (*e. g.* Ulloa⁶ and Humboldt⁷) are of opinion that the natives were ignorant of the medicinal qualities of the bark until the Spaniards discovered them.

The traditions of the mode of discovery of the remedial power are of a very fabulous character. One, told by Geoffroy, is that an Indian was cured of an ague by drinking at a pool into which some cinchona trees had fallen.⁸ Another, related by Condamine, is that the Indians observed that the American lions, when ill with ague, ate the cinchona bark! A third, mentioned by Humboldt, and considered to be less improbable, is that the Jesuits accidentally discovered the bitterness of the bark, and tried an infusion of it in tertian ague.

The period when bark was first introduced into Europe is usually stated to be 1640; but Sebastian Badus⁹ gives an extract from a letter of a Spanish physician,

¹ *Treatise on Diseases of the Chest*, by Forbes, 2d edit. p. 418.

² *Physiological Chemistry*, translated by Dr. Day, vol. i. p. 138, Cavendish Society, 1851.

³ *Tractatus de Materia Medica*, t. ii. p. 179, 1741.

⁴ *Quinologia*, Madrid, 1792 (German translation, 1794).

⁵ Weddell, *Hist. Naturelle des Quinquinas*, p. 15, 1849.

⁶ *A Voyage to South America*, English translation, 3d edit. vol. i. p. 323, 1772.

⁷ *Lambert's Illustration of the Genus Cinchona*, p. 22, 1821.

⁸ Weddell (*op. cit.* p. 40) observes, that he doubts whether at Loxa, more than elsewhere, cinchona trees are to be found on the borders of lakes or ponds, unless they have been carried there.

⁹ Quoted by Bergen, *Monographie*, p. 84.

D. Joseph Villerobel, from which it appears that it was imported into Spain in 1632, though no trial was made of it until 1639.

The statement of Condamine,¹ that the Countess of Cinchon, wife of the Viceroy of Peru, brought some bark to Europe on her return from South America, in 1639, is not improbable; and from this circumstance it acquired the names of the *Cinchona Bark* and the *Countess's Powder* (*Pulvis Comitissæ*). About ten years afterwards it was carried by the Jesuits to Rome, and by them distributed among the members of the order, by whom it was taken to their respective stations, and used with great success in agues. Among those most active in promoting its employment was Cardinal de Lugo. In this way it acquired the names *Jesuits' Bark*, *Pulvis Patrum*, *Jesuits' Powder* (*Pulvis Jesuiticus*), *Pulvis Cardinalis de Lugo*, &c.² It fell, however, in disuse, but was again brought into vogue, in France, by Sir Robert Talbor, who acquired great reputation for the cure of intermittents by a secret remedy. Louis XIV. purchased his secret (which proved to be Cinchona), and made it public.³ Hence it became known in France as *Talbor's powder*, or the *English Remedy*.

BOTANY.—Linnaeus⁴ established the genus *Cinchona* in 1742. Endlicher⁵ first divided it into two sections or sub-genera, one of which he called *Quinquina*,⁶ in which the dehiscence of the fruit is from below upwards: the other, *Cascarilla*, in which the dehiscence is from above downwards. Weddell⁷ has formed these two sections into genera, which he calls respectively *Cinchona* and *Cascarilla*.⁸ The distinction rests not merely on the dehiscence of the fruit—an apparently trivial distinction—but on the important fact that the proper cinchona alkaloids have hitherto been discovered in the species of the first section or genus only, which, therefore, exclusively yields *true* or *genuine cinchona* barks. For these reasons, therefore, I shall follow Weddell.

Gen. Char.—*Calyx* with a turbinate tube, connate with the ovary, pubescent; limb superior, 5-toothed, persistent; the teeth valvate in præfloration. *Corolla* salver-shaped, with a terete or subpentagonal tube, limb 5-cleft; the segments lanceolate, valvate in æstivation. *Stamens* 5; the filaments inserted in and adnate to the lower tube; anthers linear, inclosed or somewhat exserted at the apex. *Ovary* crowned with a fleshy disk. *Ovules* numerous, peltate, in linear placenta, which are affixed on both sides of the dissepiment. *Style* simple; stigma bifid, concealed within the tube of the corolla, or somewhat exserted. *Capsule* ovate, oblong, or linear-lanceolate, grooved on both sides, crowned by the limb of the calyx, 2-celled, many-seeded, septicidal, dehiscing from the base to the apex, the valves disjoined, the pedicel split lengthwise. *Seeds* numerous, affixed in angular-winged ultimately free placenta. *Embryo* straight in the axis of fleshy albumen. Evergreen *trees* or *shrubs* growing in the intertropical valleys of the Andes between 10° North and 19° South latitude, at from 1200 to 3270 metres (3937 to 10,728 English feet) above the level of the sea. *Trunk* and *branches* terete, with a bitter bark rich in quinia and cinchonia. *Leaves* opposite, entire, petiolated. *Stipules* usually free, and soon deciduous. *Flowers* cymose-paniculate, white or usually roseate or purplish, very fragrant. (Condensed from Weddell.)

Species—Weddell admits 21 species of this genus; but of these not more than 13 are known to yield their bark for commercial purposes.

1. *C. CALISAYA*, Weddell.—Leaves oblong or lanceolate-obovate, obtuse, attenuated at the base, rarely acute at both ends, smooth, shining, or pubescent beneath,

¹ *Mém. Acad. Sc. de Paris*, p. 226, 1738.

² Talbor, *English Remedy*, 1682.

³ *Genera Plantarum*, p. 556, 1836–40.

⁴ According to Condamine, *Quina* signifies, in the Quichoa language, “a bark;” and the duplication of the word (*Quina Quina*) would be equivalent to saying “the bark of barks.”

⁵ *Hist. Nat. des Quinquinas*, 1849.

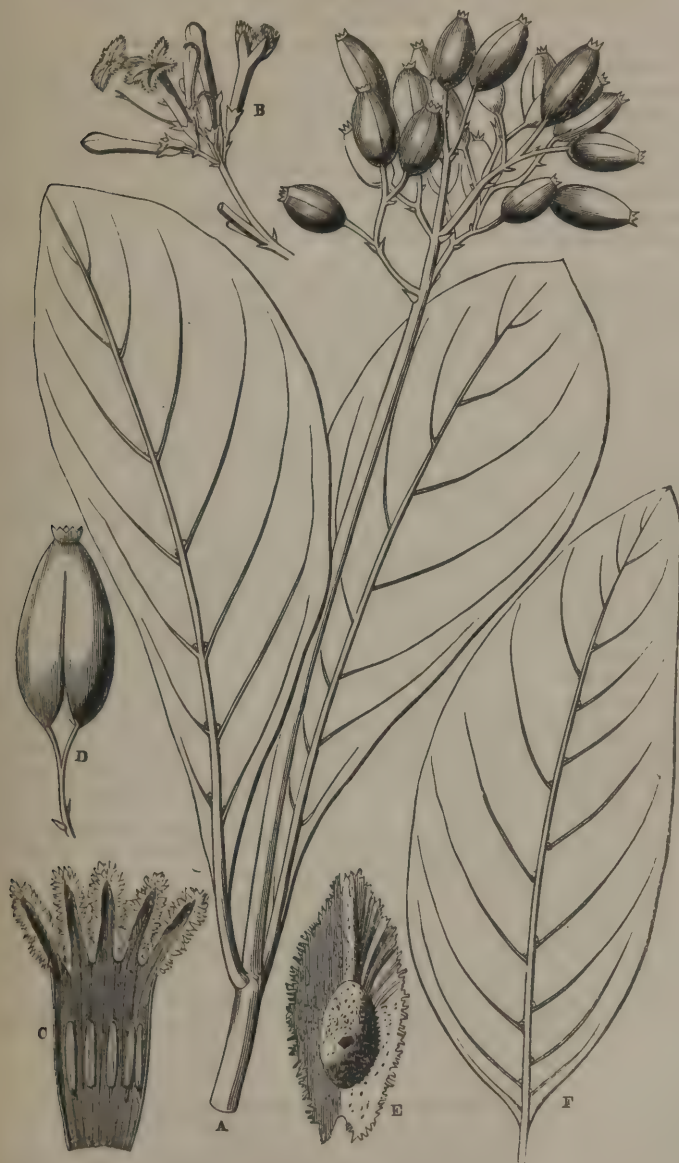
⁶ This name (*cascarilla*) for the new genus is highly objectionable (especially in a pharmaceutical point of view), on account of its being already in use to designate a well-known euphorbiaceous bark (*cascarilla* or *eleutheria bark*, see *ante*, p. 370).—The word *cascarilla* is the diminutive of *cascara* bark, and, therefore, literally signifies “small bark.”

⁷ Geoffroy, *op. supra citato*.

⁸ *Genera Plantarum*, ed. 2nda, p. 527, 1742.

pitted in the axils of the veins. Filaments usually shorter than one-half the length of the anthers. Capsule ovate, scarcely equal in length to the flowers. Seeds frequently fimbriate-denticulate at the margin (Weddell).—Bolivia and Southern Peru.

Fig. 325.

*Cinchona Calisaya.*

A, Fruit-bearing branch (from a specimen collected in the province of Carabaya, in Peru).
 B, Flowers (natural size).
 C, Corolla laid open (magnified).

D, Capsule (magnified).

E, Seed (magnified).

F, Leaf of var. *Josephiana* (from a specimen gathered in the province of Yungas, in Bolivia).

Weddell has described two varieties of this species; they are as follows:—

α. CALISAYA VERA.—A tree, with obtuse oblong obovate or oblong-lanceolate leaves.—A tall tree. Trunk straight or bent, naked, not unfrequently twice the thickness of a man's body. The leafy head for the most part elevated above all the other forest trees.

It grows in declivities and steep and rugged places of the mountains, at an altitude of from 1503 to 1800 metres [4921 to 5905 English feet], in the hottest forests of the valleys of Bolivia and Southern Peru; between 13° and 16° 30' South latitude, and from 68° to 72° West longitude; in the Bolivian provinces of Enquisivi, Yungas, Larecaja, and Caupolican; and in the Peruvian province of Carabaya. It flowers in April and May.

The bark is commonly called indiscriminately by the Spaniards and Indians, *Cascarilla Colisaya*, *Calisaya*, or *Culisaya*. It is the genuine *Calisaya* or yellow bark of English commerce.

β. JOSEPHIANA.—The *Ichu-Cascarilla* or *Cascarilla del Pajonal*¹ [*Mearlow Cinchona*] of the natives. A shrub with somewhat acute, oblong-lanceolate or ovate-lanceolate leaves.—From 6½ to about 10 feet high, with a slender branched trunk of from 1 to 2 inches thick. Branches erect. Bark adhering firmly to the wood; that of the trunk and branches selistaceo-blackish, smoothish, or furnished with different lichens, and marked in an annular manner by some narrow, distant cracks; that of the branchlets reddish brown. It grows in mountainous meadows in the same regions as the preceding variety. Both the bark of the trunk and branches, and of the stumps of the larger roots, is collected and occasionally imported with *Calisaya* or yellow bark.

2. C. CONDAMINEA, Weddell.—Leaves lanceolate, ovate or subrotund, usually acute, very smooth and shining above, beneath sometimes pitted in the axils of the veins. Teeth of the calyx triangular-acuminate or lanceolate. Filaments nearly equal to, or larger than, half the length of the anthers. Capsule oblong or lanceolate, much longer than the flowers. Seeds elliptical, toothletted at the margin. (Weddell.)

Of this species Weddell makes four varieties, as follows:—

α. CONDAMINEA VERA; *Quinquina*,² Cond. Mém. de l'Acad. Roy. 1738; *Cinchona officinalis*, Sp. Pl.; *C. Condaminea*, Humb. and Bonpl. Pl. Æq. i. 33, t. x.—Leaves ovate-lanceolate, acute, pitted in the axils of the veins. Limb of the calyx subcampanulate, with triangular teeth. Capsule oblong-ovate, scarcely twice as long as it is broad (Weddell).—On the declivities of the mountains of Quito, in the province of Loxa, between 3° 42' and 4° 40' South latitude, at an elevation of from 1600 to 2400 metres (= from 5249 to 7874 English feet). Its bark is called by the Spaniards *Cascarilla fina*³ de *Uritusinga*, and forms part of the *Loxa* or *crown bark* of commerce. Caldas⁴ states that it yields a yellow bark (probably the *Quinquina jaune* or yellow *Cinchona* of Condamine, and hence is called *Cascarilla fina amarillo* [fine yellow bark] by the natives. A sub-variety yields a red bark (probably the *Quinquina rouge* or red bark of Condamine), and is in consequence termed *colorada fina* [fine red]. Its leaves are thicker and blunter.

β. CANDOLLI; *C. macrocalyx*, Pav. MSS. ined.; De Cand. Prodr. iv. 353.—Leaves obovate or subrotund, wedge-shaped, rotund, or subcordate at the base, acute at the apex. Limb of the calyx campanulate, smoothish, with lanceolate teeth. Stigmata subexserted (Weddell).—Cuenca. Its bark probably forms a portion of the *Loxa* bark of commerce. It occurs in Pavon's collection in the British Museum under the names of *Cascarilla de Quebro de Cuenca de Loxa*, and *Quina negra*⁵ [black cinchona].

γ. LUCUMEFOLIA; *C. lucumefolia*, Pavon, in Herb. Lamb.; Lindl.; Fl. Med. p. 416.—Leaves elliptical-lanceolate, very obtuse, attenuated at the base. Limb of the calyx subcampanulate, with triangular, subacuminate teeth (Weddell).—Loxa.—The bark of this variety is called by the Spaniards *cascarilla con hojas de Lucuma* [the lucuma-leaved cinchona bark]. Specimens of it are contained in Pavon's collection in the British Museum.⁶ It occurs in large quills with a white silvery, lustrous, or corky coat, and is found occasionally in *Loxa* bark. A chest of it was put up for sale in London, in 1848, under the name of *crown bark*; but it is very different from the bark usually known by this name.

δ. LANCIFOLIA; *C. lancifolia*, Mutis, Papel periodico de Santa Fé, Num. iii. Oct. 11, 1793, p. 465; Humboldt, in Lambert's Illust. p. 51; *C. angustifolia*, Ruiz and Pav. Suppl. a la Quinol.

¹ Weddell says that *ichu* in the Quichua language and *paja* in the Spanish signify herb or grass.—*Paja*, however, strictly signifies "straw."

² Condamine's plant is usually regarded as identical with Humboldt's *C. Condaminea*; but Gaisboert (*Hist. des Drog.* 4me edit. t. iii. p. 99), who has pointed out some differences between them, proposes to distinguish Condamine's plant by the name of "*Cinchona academica*."

³ I am indebted to Mr. Berthold Seemann for a specimen of bark gathered by himself in the neighbourhood of Loxa from a tree called there "*Quina fina*." This bark corresponds to what I have termed *fine silvery crown bark*. Mr. Seemann was also kind enough to lend me, for examination, dried specimens of the flowers and leaves taken from the same branch which he had decorticated. The plant is undoubtedly Humboldt's *Cinchona Condaminea*.

⁴ *Pharmaceutical Journal*, vol. xi.

⁵ J. E. Howard, *op. supra cit.*

⁶ J. E. Howard, *Pharm. Journ.* vol. xi. 1862.

p. 21.—Leaves lanceolate or ovate-lanceolate, acute at both ends, without pits. Teeth of the calyx short, triangular. Anthers usually shorter than the filaments. Capsules for the most part lanceolate (Weddell).—Peru, Equador, and New Grenada. In Santa Fé, the bark is known by the name of *quina naranjada*, or orange-coloured bark. It is extensively imported into England from Carthage and other ports of the Caribbean Sea; and is best known to our dealers by the name of *Caqueta* or *Coqueta* or *Bogota bark*. It is the bark which I formerly designated as *new spurious yellow bark*, and which M. Guibourt described as *spongy Carthage bark* (*quina de Carthage spongieux*). He now calls it *Mutis's orange-coloured bark* (*q. orangé de Mutis*).

4. *PITAYENSIS*.—*C. lanceolata*, Benth. —Leaves lanceolate, very acute at both ends. Limb of the calyx 5-parted; the segments linear (Weddell).—New Granada.—It is the probable source of *Pitaya*, Colombia, or *Antioquia bark* (the quinquina *Pitaya* of M. Guibourt—not the *Tecamez*, or *Acatamez*, or bicoloured bark, which is sometimes called *Pitaya bark*).

3. *C. SCROBICULATA*, Weddell.—Leaves oblong or lanceolate, acute at both ends, somewhat coriaceous, above shining, beneath smoothish and minutely pitted in the axils of the veins. Teeth of the calyx triangular, acute. Capsule ovate-lanceolate, scarcely twice as long as it is broad. Wing of the seeds narrowed at the base, setose-toothletted at the margin (Weddell).—Peru; between 4° and 13° of South latitude, at about the same altitude as *C. Condaminea*. It chiefly occurs in Jaen, Cuzco, and Carabaya. Its bark is largely collected, and is sold as a substitute for the *Calisaya* sort, to which it is greatly inferior. It is to this bark that Guibourt has especially applied the name of *light* (or *flimsy*) *Calisaya of commerce* (*Calisaya léger du commerce*).

Of this species Weddell makes two varieties:—

a. *GENUINA*, *scrobiculata*, Humb. and Bonpl. Pl. *Æquin.* i. p. 165; *C. purpurea*, Lambert, Ill. p. 6; *C. micrantha*, Lind. Fl. Med. p. 412.—Leaves oblong.—Peru.—Its bark is termed by the Peruvians *Cascarilla colorada del Cuzco* [red Cuzco bark], or sometimes *Cascarilla de Santa-Ana* [St. Ann's bark].

Humboldt¹ says that this species forms immense forests in the province of Jaen de Bracamoros, where it is called *Quina fina*. He adds that the inhabitants of the town of Jaen annually gather large quantities of its barks, which they send to Piura, where they are shipped, on the Pacific, for Lima. These facts would lead us to presume that some portion of the *Loxa* barks of commerce is derived from this species.

b. *DELONDRIANA*.—All the leaves sublanceolate, smaller than in the typical plant. The pits not very conspicuous.—Middle Peru.—The bark of this variety is known in the London market by the name of *Peruvian Calisaya*.

4. *C. AMYGDALIFOLIA*, Weddell.—Leaves lanceolate, subacuminate, acute, attenuated at the base, above shining and veiny, beneath smoothish. Stipules subpersistent. Teeth of the calyx triangular, acute. Anthers equalling the filaments. Capsule lanceolate, slightly pubescent, 3 or 4 times longer than it is broad. Seeds acutely toothletted at the margin (Weddell).—Bolivia and Peru, between 13° and 17° South latitude.—Its bark is called in Peru *cascarilla-echenique*,² and by the Bolivians *cascarilla-Quepo* or *Quepo-cascarilla*, but it has no reputation with them. It occasionally occurs in English commerce, but is not distinguished by any name.

5. *C. NITIDA*, Ruiz and Pavon; Lindl.—Leaves lanceolate-obovate, acute, attenuated at the base, smooth on both sides, shining or slightly hairy beneath, not pitted. Filaments equalling the anthers. Capsule lanceolate, twice as long as it is broad. Seeds lanceolate, toothletted at the margin (Weddell).—In Peru, especially Huanuco, Panatahuas, Casapi, Cuchero, &c., about 10° North latitude.—The bark of this species forms a portion of the *Huanuco* or *gray bark* of English commerce.

6. *C. AUSTRALIS*, Weddell.—Leaves broadly elliptical or obovate, obtuse, acute at the base, very smooth on both sides, shining, minutely pitted beneath in the axils of the veins or veinlets. Capsule ovate-lanceolate, remarkably attenuated superiorly. Wing of the seeds setose-toothletted at the margin (Weddell).—South Bolivia, at about 19° South latitude, at an altitude of about 1200 metres [3937 Engl. feet]. Its bark, called by the Bolivians *Cascarilla de la Cordillera* or *de*

¹ *Plantes Équinoxiales*.

² It is so called after a certain Colonel Echenique, who collected it in the hope of making a good speculation of it.

Piray, or *Cascarilla de Santa Cruz de la Sierra* [Cordillera, Pira, or Santa Cruz de la Sierra bark], is, perhaps, to be occasionally met with in English commerce, but I have not been able to identify it.

7. *C. BOLIVIANA*, Weddell.—Leaves elliptical or oblong-obovate, obtuse, cuneate or attenuated at the base, smooth above, smoothish or pubescent and purplish below. Teeth of the calyx triangular. Filaments equalling the anthers.—Bolivia and Peru. In Bolivia, it grows in the same localities as the *C. Calisaya*; also in some of the valleys of the Peruvian province of Carabaya, at 13° South latitude. Its bark is called in Bolivia *Calisaya morada* [mulberry-coloured *Calisaya*], and in Peru *Cascarilla verde* [green] *morada*.¹ It is usually intermixed with the bark of *C. Calisaya*, and constitutes, therefore, part of the *Calisaya* bark of commerce. Guibourt classes it among the *light or flimsy Calisaya barks* (*Calisayas légers*).

8. *C. MICRANTHA*, Weddell.—Leaves broadly ovate, obovate, or roundish, rather obtuse, more or less attenuated at the base, membranous, smooth above, very slightly pubescent beneath, pubescent or hairy on the veins and in the axils. Teeth of the calyx short and acuminate. Fruit-bearing panicle thyrselike, somewhat compressed. Capsule lanceolate. Wing of the seeds toothletted at the margin (Weddell).—This species grows in the Bolivian provinces Larecaja and Caupolicán; in Carabaya, and also near Chicoplaya and Playa Grande, in Peru. Its bark is called by the inhabitants of Huanuco, *Cascarilla provinciana*; in Carabaya, it is termed *Motosolo*; and by the Bolivians, *Quepo Cascarilla* or *Cascarilla verde*. It is collected in large quantities in Carabaya, and is confounded with the bark of *Cinchona ovata*, under the name of *Cascarilla morada ordinaria*. The quilled bark constitutes part of the *Huanuco* or *gray barks* of English commerce; the flat pieces are used to adulterate *Calisaya* bark.

Weddell makes two varieties of this species.

α. *ROTUNDIFOLIA*; *C. micrantha*, Ruiz and Pavon.—Leaves ovate-rotund.—Peru and Bolivia.

β. *OBLONGIFOLIA*, *C. affinis*; Weddell.—Leaves oblong-ovate.—Peru.

9. *C. PUBESCENS*, Weddell.—Leaves broadly ovate, subacute, at the base (especially in the younger ones) attenuated, membranous, above smoothish, beneath pubescent, with short petioles. Teeth of the calyx triangular-acuminate. Anthers subsessile. Fruit-bearing panicle loose, straggling. Capsule linear-lanceolate. Seeds setose, toothletted at the margin (Weddell).—Peru and Bolivia.—It occurs frequently between 4° and 16° South latitude.

Weddell admits two varieties of this species.

α. *PELLETERIANA*; *C. pubescens*, Vahl.—Leaves on both sides green.—The bark of this variety is known in its native country as *carua-carua* or *cargua-cargua*² (indicative of its inferior quality). In Carabaya, it is also called *cascarilla* or *quinia amarilla* [yellow bark]. It is known in Europe as *Arico* or *Cusco* bark.

β. *PURPUREA*; *C. purpurea*, Ruiz and Pav.; *Cascarilla morada*, Ruiz.—Adult leaves purplish beneath.—In the valleys about Huanuco, the bark of this variety is called *cascarilla bobo* de *hojas moradas* [the mulberry-leaved booby bark].

10. *C. CORDIFOLIA*, Weddell.—Leaves ovate-suborbicular, obtuse at both ends, or cordate or slightly attenuated at the base, submembranous above, at length smoothish, beneath pubescent, usually with long petioles. Teeth of the calyx short, mucronate. Anthers much longer than the filaments. Panicle subcorymbose. Capsule lanceolate. Wing of the seeds toothletted at the margin, and with small holes (Weddell). This species grows at an altitude of from 1700 to 2700 metres [=5577 to 8858⁴ English feet].

Weddell makes two varieties of this species.

α. *VERA*; *C. cordifolia*, Mutis, MSS. apud Humboldt, in Lamb. *Illustr.* p. 54; Lindl. *Fl. Med.*—

¹ These names have reference to the colour of the leaves, not of the barks.

² *Carua* or *Cargua* signifies the Llama—an animal considered to be of an inferior kind. The duplication of the word gives force to the expression, and may be taken to signify (figuratively) “very bad” or “very inferior.”

³ The word *bobo* is equal to that of *fool* or *booby*. The inhabitants have given it this name because, having the same good qualities as the other cinchonas, it has not their colour (Laubert).

⁴ Boussingault and Goulot state that it occurs most abundantly at an elevation of 1969 English feet (Boussingault's *Rural Economy*, Engl. transl. 2d edit. p. 205, 1845).

Leaves subcordate, pubescent beneath.—New Granada and Peru. Its bark is the *quina amarilla* or *yellow bark of Santa Fé*, better known in the English market as *hard Carthagena bark*. By the common people in New Granada it is called *velvet bark*.

β. ROTUNDIFOLIA; *C. rotundifolia*, Pavon, in Lamb. Ill. p. 5; Lindl. Fl. Med.—Leaves rotund, obtuse at both ends, denuded or with veins beneath, and with pubescence above.—Loxa.—It is probably the source of the *ashy crown bark* of commerce.

11. *C. PURPURASCENS*, Weddell. Leaves large, suborbicular, acute, attenuated at the base, membranous, smoothish above, downy beneath, the younger ones sessile. Stipules ovate-lanceolate.—Bolivia.—Guibourt thinks that its bark is what he has termed *white Loxa cinchona*, but which Weddell thinks is furnished by *C. cordifolia* and *pubescens*.

12. *C. OVATA*, Weddell.—Leaves broadly ovate, subacute, attenuated at the base, subcoriaceous, above at length smoothish, beneath pubescent-tomentose. Teeth of the calyx short, acute. Anthers much larger than the filament. Fruit-bearing panicle diffuse. Capsule lanceolate or oblong-lanceolate. Wing of the seeds fimbriate-toothletted at the margin (Weddell).

Weddell admits three varieties of this:—

α. VULGARIS; *C. ovata*, Fl. Peruv.; *C. pubescens*, Lambert; *C. pubescens* var *β*, De Cand.—Leaves on both sides green. The bark, when dry, yellow; the cellular coat persistent, or at length separating more or less from the liber (Weddell).—Peru and Bolivia; from 9° to 17° South latitude, at an altitude of from 1800 to 2300 metres [=5905 to 7546 Engl. feet]. This variety yields the bark called in South and Middle Peru, *Cascarilla pata de Gallareta*, or *Cascarilla pata de Gallinazo*.¹ This bark is frequently met with in English commerce, and is known by the names of *Ash*, *Jaen*, or *Ten bark*.

To this variety must also, for the present, be referred the bark now largely imported into England under the name of *Carabaya bark*, which Dr. Weddell has recently assured Mr. J. E. Howard is the produce of *C. ovata*, var. *α vulgaris*.

β. RUFINERVIS—Leaves beneath sanguineo-venous. The dry bark yellowish, the cellular tunic at length separating from the liber. Carabaya in Southern Peru, and Bolivia. In Peru, the bark is called *Cascarilla-Carabaya*, and sometimes *Cascarilla zamba-morada*.

γ. ERYTHRODERMA.—Leaves submembranous, beneath pubescent, green on both sides. Dry bark of a deep reddish-brown colour, the cellular coat persistent. Peru. The bark of this variety is of a red colour.

13. *C. GLANDULIFERA*, Ruiz and Pavon.—Leaves ovate-lanceolate, acute at both ends, above smoothish, beneath glandular-hairy, and fitted in the axils of the veins. Teeth of the calyx short, triangular, subacuminate (Weddell).—Peru, in 10° South latitude, especially about Panatahuas, Chicoplaya, Monzon, and Cuchero. Its bark, called *Cascarilla negrilla* [blackish bark], forms, according to Peoppig, one of the best Huanuco barks.

14. *C. HIRSUTA*, Ruiz and Pavon.—Leaves elliptical ovate, obtuse, usually subacute at the base, coriaceous, above veiny, ultimately smooth, beneath with setose-pilose veins. Teeth of the calyx lanceolate acuminate. Tube of the corolla pubescent within at the base of the filaments. Wing of the seeds broad, toothletted (Weddell).—Peru; about Pillao, Acomao, and Panatahuas, at 10° South latitude. Its bark is called *Cascarilla delgada* or *delgadilla* [slender bark] by the Peruvians. It may, perhaps, be the bark known in English commerce as *wiry crown bark*.

The remaining seven species of Cinchona are not known to yield any of the Cinchona barks of commerce.

15. *C. CHOMELIANA*, Weddell.—Bolivia.—Its bark approximates in character to that of *C. ovata*.

16. *C. ASPERIFOLIA*, Weddell.—Bolivia.—A small tree.

17. *C. HUMBOLDTIANA*, Lambert, Ill. 7; *C. villosa*, Lindl. Fl. Med.—Peru.

18. *C. CARABATENSIS*, Weddell.—Peru.—Its bark is very thin, and has not been collected for commercial purposes.

19. *C. MUTISII*, Lambert, Ill. 9; *C. glandulifera*, Lindl. Fl. Med.—Loxa.

Weddell notices two varieties of this:—

α. microphylla; *C. microphylla*, Mutis; *C. quercifolia*, Pavon, in Lamb. Ill. p. 9.—This

¹ *Pata de gallareta*, foot of the wild duck; *pata de gallinazo*, foot of the black vulture (*Vultur Aura*). Peoppig says that the latter name arises from the blackish and radiated appearance caused by some species of *Graphis*, which generally grows upon the bark.

variety is commonly called *Cascarilla con hojas de roble* [oak-leaved cinchona]; and under this name there is a bark in Pavon's collection in the British Museum. It is in quills, with a whitish epidermis, and approximates in appearance to either *C. lancifolia* or *lucumæfolia* bark.

β. *crispa*; *C. quercifolia* var. *crispa*, Pavon, in Lamb. Ill. p. 9.

20. *C. DISCOLOR*, Klotzsch.—Peru.—*Cascarilla hoja de Oliva* [olive-leaved cinchona].

21. *C. PELALBA*, Pavon.—Peru?

BARK-PEELING.—The method of peeling and preparing the cinchona barks for the market has been noticed by Gray,¹ by Stevenson,² by Ruiz, by Pöppig, and more recently by Weddell.

The name of *cascarilleros* [bark-peelers], Mr. Weddell states, is given not only to the men who cut the cinchonas in the woods, but also to those who are specially engaged in this commerce. They gather the bark at all seasons, except the rainy season, which in duration corresponds with our winter; and even during this period the collection of the bark is only suspended on account of the physical obstacles to its continuance.

The cutters are not generally engaged on their own account, but are mostly in the service of some merchant or small company; and are accompanied into the forests by a confidential person called the *mayordomo* or *major domo*, whose duty it is to receive and examine the barks brought to him by the different parties in the forest, and to superintend the distribution of provisions.

The first thing done by those who engage in this kind of speculation in a region previously unexplored, is to have it examined by experienced *cascarilleros*, who are called *diestros* or *practicos* [skilled or experienced persons]. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. If their report be favourable, a road is immediately commenced up to the point which is to form the centre of the operations; and from this time all those parts of the forests adjacent to the road become provisionally the property of those who have formed it, and no other *cascarilleros* can work there.

On the arrival of the *major domo* with his cutters in the neighbourhood of the part to be explored, he chooses a favourable site for his encampment, as near as possible to a spring or river. He constructs a hut to shelter the provisions and the produce of the cuttings; and if he anticipates having to remain for some time in the same locality, he commences the cultivation of maize and a few vegetables. Experience, indeed, has shown that an abundant supply of provisions is one of the most important conditions of success. The *cascarilleros*, during this time, are distributed through the forest, one by one, or in small parties, each carrying, under his *poncho* or cloak, and suspended at his back, provisions for several days, and the coverings which constitute his bed.

The cinchonas rarely constitute an entire forest, but form more or less compact groups, called *manchas*, distributed in different parts of it. In some cases, and most frequently, they grow separately. However this may be, it is in discovering them that the skill of the *cascarillero* is principally exerted. If the position be favourable, the tops of the trees first attract his notice; a slight movement peculiar to the leaves of certain species, a particular colour of the foliage, the aspect produced by a great mass of inflorescence, enable him to distinguish the cinchonas from a great distance. Under other circumstances he confines his inspection to the trunks, of which the external layer of the bark, or *enves*, as it is called, presents remarkable characters. Very frequently, the dry leaves which he finds on the ground are sufficient to indicate to him the vicinity of the object of his search; and if these indications have been brought there by the wind, he knows in what direction to look. An Indian, under these circumstances, is an interesting object for observation. Passing in and out through the narrow pathways of the forest, glancing through the foliage, and appearing to sniff the earth, he seems to walk like an animal pursuing its prey, and darts forth when he thinks he has discovered the object of his search. He does not stop until he has arrived at the foot of the trunk which he has descried from the distance. It is not always, however, that the exertions of the *cascarillero* are productive of such favourable results. Too often he returns to the camp empty handed, and without provisions; and not unfrequently, when he has discovered on the side of a mountain, indications of the tree, he finds himself separated from it by a torrent or ravine. Entire days may then pass before he can attain the object which, during this period, he allows not to escape from his sight.

In order to strip the tree of its bark it is felled with a hatchet, being cut a little above the root, and the bark previously removed from this part, so that nothing may be lost; and as at the base the bark is thickest, and, therefore, most profitable, it is customary to remove the earth from around the trunk, so that the barking may be more complete. The tree seldom falls immediately when cut through, being sustained either by climbing plants or by the adjacent trees; these are fresh obstacles to be overcome by the *cascarillero*. I remember, says Mr. Weddell, having once cut the trunk of a large cinchona in the hope of bringing its flowers within

¹ From the papers of Mr. Arrot; *Phil. Trans.* 1737—8, vol. xl. pp. 81—6.

² *Narrative of Twenty Years' Residence in South America*, vol. ii. p. 66, 1825.

reach, and, after having felled three adjacent trees, had the mortification to find it yet standing, being held up by the interlacing creepers.

When at length the tree is down, and the useless branches have been cut off, the periderm is removed by striking it with either a little wooden mallet, or the back of the hatchet; and the inner bark, being thus exposed, is often farther cleaned by means of a brush. The bark is then divided by uniform incisions circumscribing the pieces which are to be removed, and these are separated from the trunk with a common knife or some other instrument, the point of which is carried as close as possible to the surface of the wood on introducing it into the incisions previously made; and if the position of the trunk prevents the operator from removing the whole of the bark by the first operation, it is subsequently divided so as to admit of its being turned. The dimensions and regularity of the pieces necessarily depend more or less on circumstances; in general, however, for the convenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inches long, and four or five inches wide. The bark of the branches is separated in the same way as that of the trunk, excepting that it is not deprived of its exterior coating or periderm.

The details in the process of drying also vary slightly in the two cases; the thinnest pieces of bark from the branches or small trunks, intended to make the *quilled bark* or *canuto*, are simply exposed to the sun's rays, and they take of themselves the desired form, which is that of a hollow cylinder; but the bark taken from large trunks, which is to constitute the *flat cinchona*, or, as it is called, *tabla* or *plancha*, must necessarily undergo a certain degree of pressure during the process of desiccation, without which it would become misshapen, or take a cylindrical form, as in the preceding case. To effect this, after first exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that practised in timber-yards in the arrangement of the planks of wood; and on the top of this pile a heavy weight is placed. This process is repeated for several days until the bark is completely dried.

In many places the bark is not pressed at all, or but imperfectly so, and it is then generally

Fig. 326.



The Valley of San Juan del Oro.

Bark-peeling in the Forests of Carabaya in Peru.

(One of the *cascarilleros* or barkers is represented as engaged in barking a felled stem; two others are occupied in piling the bark in square heaps to flatten and dry it; while a fourth is seen in the distance carrying a load of the dried bark on his back to the camp.)

out of form or slightly curled. The periderm is often but partially removed, or simply scraped. Finally, whether it be accidental, or whether it be done with the view of augmenting the weight, there frequently remains a certain quantity of moisture in the bark which greatly deteriorates it. The labour of the *cascarillero* is by no means ended, even when he has finished the preparation of the bark; he has yet to carry his spoil to the camp, and, with a heavy load on his shoulders, to retrace his steps along those parts which, while unburdened, he traversed with difficulty. The labour involved in this part of the operations can hardly be conceived. Mr. Weddell has seen more than one district where the bark had to be carried for fifteen or twenty days' journey to get it out of the wood from which it was obtained.

The packing of the bark is effected by the *major domo*. As the cutters bring him the bark, he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depots in the towns, where they generally receive an exterior envelop, consisting of a fresh hide, which as it dries makes a hard and compact package. In this form the packages are known by the name of *serons*, and it is thus that they arrive in Europe. The usual weight of a *seron* is from 70 to 80 kilogrammes (=156 to 176 lbs. avoirdupois); but it is sometimes much less than this.

DESCRIPTION. *a. General Description.*—Before describing the various kinds of cinchona barks met with in commerce, it will be necessary to offer a few remarks on their general characters. These may be noticed under the following heads: *cryptogamia, structure, fracture, markings, quilling, colour, taste, and odour.*

1. CRYPTOGAMIA FOUND ON CINCHONA BARKS.—These, especially the Lichens, have been elaborately examined by Fée¹ and by Zenker.²

a. Musci, or Mosses.—We frequently find mosses on Cinchona barks; but as they are never met with in fructification, it is almost impossible to determine the genus to which they belong. They are probably species of *Hypnum*.

β. Lichenes.—These are found in great abundance, especially on *Loxa* or *Crown bark*. Formerly their presence was considered to be a mark of goodness of barks, which were valued in proportion to the number of lichens growing on them.

We may conveniently arrange them, according to Zenker, in four sections: Sect 1. *Conioid lichens*, or the powdery lichens (*Lichenes pulveracei*).—In this section, we have *Lepra flava*. Sect. 2. *Cryolichenes*, or the crustaceous lichens (*Lichenes crustacei*).—These frequently put on very beautiful forms, and so colour the surface of the epidermis that they appear to constitute a part of this coat. In that kind of pale bark usually called *gray*, or *silver*, the surface of the epidermis has a white cretaceous appearance, from the presence of various species of *Arthonia* and *Pyrenula*. Sect. 3. *Phyllolichenes*, or the foliaceous lichens (*Lichenes foliacei*).—These are found most abundantly on the *Crown* or *Loxa bark*. The most common species belong to the genera *Parmelia*, *Sticta*, and *Collema*. The *P. coronata* is a beautiful species, and one frequently met with. So also the *Sticta aurata*, remarkable for its yellow colour. Sect. 4. *Dendrolichenes*, or the filamentous lichens (*Lichenes fruticosi*).—The *Usneas* are good examples of this section; they are found in abundance on the *Crown bark*. Two species are met with—*U. florida* and *U. barbata*; a variety of the latter is curiously articulated.

γ. Hepaticæ.—*Jungermannias* are found on Cinchona barks, but in too broken a condition to determine their species. Fée, however, examined Humboldt's Herbarium, and found four.

δ. Fungi.—As Fungi usually grow on weakly or dead trees, their presence on Cinchona bark is a bad characteristic. Very few, however, are met with. That most commonly met with (especially on quilled *Calisaya bark*) is *Hypochnus rubrocinctus*, a red fungus.

2. STRUCTURE.—The bark of young Cinchona stems consists of four parts: 1st, the *epidermis* or outer coat, composed of a row of oblong, brownish cells, flattened in the direction from without inwards, and often partially destroyed or blended with the thallus of lichens. 2dly, the *epiphylæum*, also called *phleum*, *periderm*, or *suberous coat*, composed of layers of oblong tabular cells, which in some barks (as those of *C. pubescens* and *amygdalifolia*) constitutes a layer of true cork, but in others consists of a modified cork, which is distinguished by the name of the *resinous circle*. 3dly, the *mesophylæum*, placed immediately within the suberous coat, and sometimes termed the *cellular* or *herbaceous envelop* or *green layer*. It is composed of regular cells, which are flattened in the direction from without inwards, and contain resinous matters which readily dissolve in alcohol. This coat is separated from the liber by one or two rows of *lucina* analogous to *laticiferous vessels*, from which, in the fresh bark, a gummy-resinous, astringent rather than bitter, fluid escapes. 4thly, the internal tunic called the *endophylæum* or *liber*, and composed of pentagonal cells filled with resinous matters, and of woody tissue (*pleurenychyna*), forming the *cortical fibres*.

During the growth and augmented diameter of the ligneous action of the stem, the inner portion of the bark continues to live and grow also, but the outer portion dies, and either remains

¹ *Essai sur les Cryptog.* 1824.

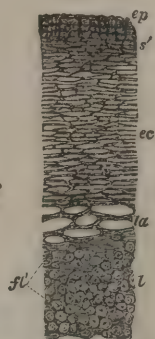
² Goebel and Kunze. *Pharm. Waarenk.* S. 109

attached to the inner living portion, forming what is called *coated bark* (*cinchona cum cortice exteriore* of Bergen), or exfoliates and falls off. This dead part is termed by Weddell¹ the *periderm*—while the living part he calls the *derm*. Thus, he applies the term *periderm* to what the druggists commonly call the *coat* of the bark; and the word *derm* to what is usually termed *uncoated bark*, or *bark deprived of its coats* (*cinchona nuda* of Bergen).

3. FRACTURE.—The character of the transverse fracture furnishes an important criterion of the quality of bark, and has long been in use among dealers. It depends mainly on the anatomical elements of the bark, but partly also on the contents of the cells. Thus, cellular tissue breaks with a short and smooth fracture, and when the cells abound in resin, the fracture becomes glistening and resinous. Woody tissue, on the other hand, breaks with a fibrous fracture. In a general way, therefore, it may be stated that there are but two kinds of fracture—1st, the *short and smooth*; and 2dly, the *fibrous*. But of the fibrous fracture there are three varieties, viz. the *short fibrous*, the *stringy*, and the *ligneous* or *woody*. These are respectively shown in the bark of *C. Calisaya*, *scrobiculata*, and *pubescens*. (See Figs. 328 to 330 inclusive.)

The cause of these peculiarities is to be found in the anatomical structure of the bark as displayed by the microscope. In the *Calisaya* bark, the lig-

Fig. 327.



Transverse section of the very young bark of *Cinchona ovata*, showing the disposition of the layers before their modification by the progress of vegetation.

ep, Remains of the epidermis.

s', Suberous coat or resinous circle.

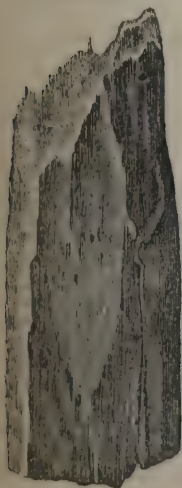
cc, Cellular envelop.

la, Lacunæ: these, as well as the cells of the cellular envelop, are filled with resinous matters, which require to be removed, in order to render the cell-walls obvious.

l, Liber.

fl', Cortical fibres.

Fig. 328.



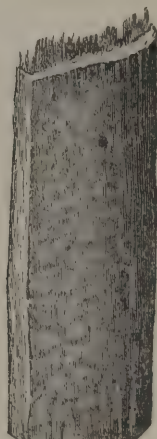
Bark of *C. Calisaya* entirely deprived of periderm.
Short-fibrous fracture of liber.

Fig. 329.



Bark of *C. scrobiculata*.
Stringy fracture of liber.

Fig. 330.



Bark of *C. pubescens* coated externally by its periderm.
Smooth or suberous fracture of the external or purely cellular portion of the bark
Ligneous fracture of the internal portion or liber.

¹ Weddell's terms are convenient, and I shall, therefore, adopt them. But they are by no means devoid of objection: for while the word *periderm* is used by Mohl, in a precise anatomical sense, to indicate the epiphloem or second coat of the bark, Weddell uses it more loosely to signify merely the dead part of the bark, and does not confine it to one tissue. Thus, in its simplest form, Weddell's *periderm* is the epiphloem or suberous coat; but in a more complex state it consists of the exfoliated mesophloem chiefly, with the lacinated suberous coat; and, lastly, in some cases it contains also a portion of the liber.

neous fibres are short, fusiform, equal, loosely attached to each other by their oblique ends, and surrounded, for the most part individually, by a cellular tissue filled with resin. In the *scrobiculata* bark the ligneous fibres are nearly twice as long, more numerous, and adherent by their more tapering extremities. Lastly, in the *pubescens* bark, we find that the ligneous fibres are

Fig. 331.

Longitudinal section of
C. Calisaya.



Fig. 332.

Longitudinal section of
C. scrobiculata.

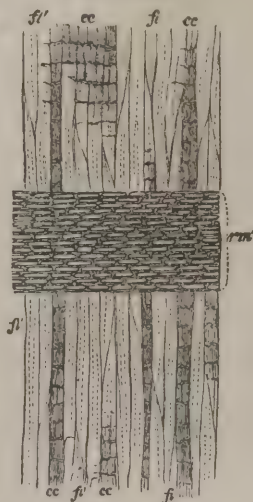
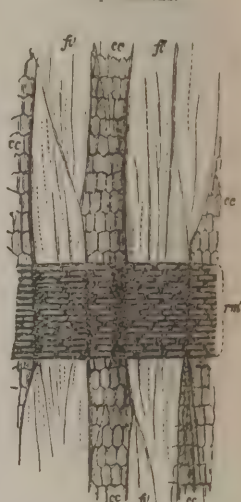


Fig. 333.

Longitudinal section of
C. pubescens.



Microscopic structure of the liber of C. Calisaya, scrobiculata, and pubescens.

fi, Ligneous fibres.

cc, Cellular tissue of the liber.

rm, Medullary rays.

three or four times as large as those of the preceding barks, and are united together in bundles: moreover, the internal face of the bark is formed in great part of cellular tissue. (See Figs. 331 to 336 inclusive.)

As *Calisaya* bark yields a larger proportion of quinine than any other bark, and breaks with a short-fibrous fracture, Weddell lays down a general rule, that the more the transverse fracture of a cinchona bark approaches to the short-fibrous form, the greater the amount of quinine which we may presume it to contain. On the other hand, the more the fracture approximates to the short or suberous form, the greater the amount of cinchonine. But these rules probably only apply to Bolivian barks.

4. SEAT OF THE ACTIVE PRINCIPLES.—I have repeatedly submitted sections of cinchona barks to microscopic examination, with the view of determining the seat and appearance of the alkaloids in their native tissues.

The liber of many barks presents, even to the naked eye, a speckled appearance, owing to the presence of minute white spots. When we examine these spots by a low magnifying power, they are seen to be cells filled with a white solid substance. If we use the compound microscope, with an object-glass of two inches focal length, the inner surface of the liber presents an amygdaloid appearance, owing to the presence of ovoid cells filled with a white substance, and imbedded in the yellowish-brown tissue of the bark. Sometimes these cells are rectangular. Longitudinal and transverse sections of the bark show that these white masses are confined to the liber, and chiefly to its inner portion. In one specimen, I discovered a thin layer of the white matter between the liber and the mesophloëm. These white masses I have met with more abundantly in the cinchonine barks. When the white substance is submitted to high magnifying power it appears like a crumbling mass, without presenting any distinct crystalline form. It is readily soluble in diluted hydrochloric acid, and the solution is not precipitated by oxalate of ammonia. It dissolves also in diluted sulphuric acid; and the solution by evaporation crystallizes. In alcohol, ether, and solution of caustic potash, it is only slightly soluble. It is probable, I think, that this white matter consists chiefly of some compound of the alkaloids of the bark.

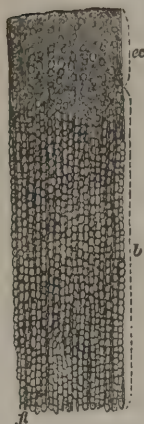
5. MARKINGS.—Furrows (*sulci*) are the result of the organizations of the stem, and are often nothing but scars (*cicatrices*) left by the fall of leaves and stipules—as the circular impressions, or annular furrows (*sulci annulati*) or rings, observed on crown or *Calisaya* barks. Rents or cracks

Fig. 334.



C. Calisaya.

Fig. 335.



C. scrobiculata.

Fig. 336.



C. pubescens.

Microscopic structure of transverse sections of the barks of *C. Calisaya*, *scrobiculata*, and *pubescens*.

cc, Cellular tissue of the liber.

cc, Cellular envelop.

f, Fibres of the liber (i. e. cortical fibres).

l, The liber.

pd, A portion of the periderm attached to the liber.

s, Suberous coat.

(*scissura vel rimæ*) are produced either by the distension of the bark during the growth of the stem, or by the drying of the bark after its removal from the stem; transverse rents or fissures from the latter cause are best seen in a false cinchona bark (*quinquina nova* of the French writers). Wrinkles (*ruga*) are usually the result of desiccation; they give the bark a shrivelled appearance. Warts, or tubercles (*verrucae vel tuberculi*), are observed on some barks, especially on red bark.

6. TASTE.—A bitter taste is essential to all good cinchona barks, and is usually assumed to indicate the presence of an alkaloid. Experienced dealers, however, have remarked that those barks whose alkaloid is cinchonine (as *C. pubescens*) more rapidly communicate a bitter taste, when chewed, than those whose base is quinine. Moreover, the cinchonine barks have a more disagreeable taste, and one allied to that of sulphate of magnesia. An *astringent* or *styptic* taste indicates the presence of tannic acid; an *aromatic* taste, volatile oil or resin.

7 and 8. COLOUR and ODOUR.—Little need be said of these characters. The same kind of bark often varies in its colour, while several kinds may have the same tint. Moisture usually deepens the colour.

8. Special Description.—In describing the various kinds of cinchona barks, some classification or arrangement of them is desirable.

In commerce, the distinction usually followed is a *geographical* one; a bark being termed Bolivian, Peruvian, or New Granadian, according to the country of its growth. This arrangement involves, for the most part, a *botanical* one; because the barks of the several countries here referred to differ from each other essentially, on account of being the produce of different species of cinchona. But such an arrangement is objectionable, on the ground that barks do not carry with them any characters by which their geographical or botanical origin can be determined.

An arrangement founded on the *physical* (including microscopical) or *chemical* characters of barks would, if practicable, be more useful. But, at present, the difficulties which stand in the way of such arrangements are insuperable. In the last edition of this work, I arranged the

barks according to their colour—a proceeding which I have subsequently ascertained to be objectionable. The same species of bark (e. g. the bark of *C. lancifolia*) which, in the young state, has a brown epidermis, is found, at a more advanced stage of its growth, to be whitish externally, owing to the exfoliation of its periderm, and the exposure of its white, micaceous, suberous coat. Moreover, the yellow or red colour of the liber, on which is founded the distinction of yellow and red barks, cannot be relied on for characterizing any particular sort of bark; since the same species of bark may, under some circumstances, be red—under others yellow. Of this we have a good example in *lancifolia* bark.

In a commercial point of view, the value of a cinchona bark depends on the quantity of quinine which it is capable of yielding; and an arrangement of barks founded on the nature of the alkaloid which they respectively contained would be the most useful both for commercial and medicinal purposes. But though, in a general way, a bark is termed a *quinine bark*, a *quinidine bark*, a *cinchonine bark*, or an *aricine bark*, yet cinchona barks cannot be correctly thus classified, because most cinchona barks contain two or three of these alkaloids, and differ from each other essentially in the relative proportion of these bases which they are capable of yielding. Their chemical distinction, therefore, is rather one of degree than of absolute difference.

In the absence of any scientific arrangement, I shall notice the barks in geographical order; commencing with the more valuable barks of the southern cinchona district (Bolivia), and, proceeding northerly, finishing with the less valuable barks of the most northern cinchona district (New Granada).

Bolivia	1 Calisaya (yellow) bark.	Ecuador	{ 7 Loxa (crown and pale) bark.
	2 Carabaya "		8 Guayaquil (red and pale) "
	3 Cusco "		9 Pitaya (condamina) "
Peru	4 Huanuco (gray) "	New Granada .	10 Bogota or Cagueta (laner) "
	5 Huamaliles (rusty) "		11 Carthagena (leaved) "
	6 Jaen (ash) "		12 Maracuibó "

I. CINCHONA CALISAYA¹ SEU REGIA.—ROYAL OR GENUINE YELLOW BARK.

Cinchona flava (regia), L.—*Cinchona flava*, E. D.

SYNONYMES.—*Quinquina Calisaya* ou *Jaune royal*, Guibourt. *China regia*; *Konigs-China*, Bergen. *China regia*; *Cortex China regius*, s. *flavus*, s. *luteus*; *China Calisaya*, Goebel.

HISTORY.—Dr. Relph² says, that in a letter from a Spanish merchant at Cadiz, dated September 1789, it is observed that the *yellow bark* had only been lately known there. "The first parcel which arrived here was tried at Madrid, and was immediately bought by the King's order for his own use." In 1790, Murray³ first saw it at Frankfort on the Maine. He afterwards received it under the name of *cortex china flavus*; and to prevent confusion he proposed to term it *royal yellow bark* (*cortex china regius flavus*). Dr. Relph says it was unknown in England till 1793; but this must be an error, for Murray, who died in 1791, had received it from London.

BOTANY.—This bark is the produce of *Cinchona Calisaya*, Weddell (see Fig. 325. p. 633).—In the *Pharmacopœia Londinensis* of 1836, and in some other works, it was ascribed to *C. cordifolia*. The error arose from the circumstance of the bark of the latter, as well as of the former species bearing the name of "yellow bark." I drew attention to the error in the former editions of the *Elements of Materia Medica*; but, as it has been rectified in the *Pharmacopœia Londinensis* for 1851, it need not be farther dilated on.

COMMERCE.—In Bolivia, there has been established a monopoly⁴ in the trade of this bark, in virtue of which it can be exported only by a National Company at La Paz; and hence the bark sold by this Company is usually known in trade as *Monopoly bark*. From time to time it has been found necessary to issue decrees⁵ prohibiting, for a limited period, the cutting of the bark, in order to protect the bark-forests (whose existence has been endangered by excessive cutting), and also to keep up the price of the bark. The effect of this monopoly has been to force the

¹ Weddell says that the etymology of the word "Calisaya" is very obscure. "M. Humboldt," [see Lambert's *Illustr.* p. 53,] he adds, "believes that it is derived from the name of the province which produces it; but well-informed people of the country have assured me that it never existed in the province of this name. In the department of La Paz, moreover, where it is found most abundantly, it more frequently bears the name of *Calisaya* or of *Calisaya*; and I am inclined to think that these names have been given to it on account of the red colour which the external face of its denuded bark often assumes on drying, of which its leaves sometimes have. For *Colli* signifies 'red' in the Quichua language; and *saya*, taken figuratively, means 'sort' or 'form.'" I prefer Humboldt's derivation, and do not see any force in Weddell's objection to it—for other drugs (e. g. Balsam of Peru, which is not the produce of Peru, but of *Sorsonate*) have been named after places which were supposed, though erroneously, to yield them. Poeppig says that "*Colta*" signifies *remedy*, and "*Salla*" *rocky ground*.

² *Inq. into the Med. Effic. of Yellow Bark*, 1794.

³ See *Pharmaceutical Journal*, vol. xi. p. 215, 1851.

⁴ *Apparatus Medicaminum*, vi. 17.

⁵ See the 2d ed. of these *Elements* (p. 1376) for a copy of the decree issued in 1837; and the *Pharm. Jour.* (vol. xi. p. 218) for a copy of the decree issued in 1850.

manufacturers of quinine to use as substitutes the inferior, but cheaper, quinine-yielding barks of Carabaya, Bolivia, and New Grenada.

Calisaya bark is usually exported from Arica, the nearest Peruvian port to the Bolivian district of La Paz.

VARIETIES AND DESCRIPTION.—Three sorts of genuine Calisaya bark are distinguished in Bolivia; these are the *orange-coloured*, the *dark*, and the *pale*.

1. *Orange-coloured Calisaya bark.*—This is called in Bolivia *Colisaya amarilla*, *C. dorada*, or *C. anaranjada* (yellow, golden, or orange-coloured Calisaya). It is the sort most frequently met with in commerce.

In commerce, two kinds are distinguished; the *quilled* and the *flat*.

a. *Quilled yellow bark* (*cinchona flava regia tubulata seu convoluta*).—The quills vary in length from three to twenty four inches; in diameter, from two lines to one and a half or even two inches; in thickness, from half to six or seven lines. Very small quills, however are rare; those usually met with having a diameter of from one to one and a half inches, and a thickness of from three to six lines. Sometimes they are doubly, though in general they are singly, quilled.

Quilled yellow bark is usually *coated*; but occasionally we meet with quills which are more or less *uncoated*. Some of these uncoated quills somewhat resemble coarse cassia lignea (*Cinnamon-like Calisaya quills*). Are they the produce of *C. Calisaya*, var. β *Josephiana*? They agree in appearance with the latter; and Mr. J. E. Howard tells me that he suspected this origin of them on account of their stypticity (see p. 649).

The periderm or coat varies in its thickness.¹ It is more or less rugous, and is marked with transverse impressions or furrows or cracks, which often form complete circles or rings around the quills, and whose edges are thick, raised, and everted. When the periderm is very thick, its substance acquires a corky or elastic consistence, and the annular furrows assume the appearance of deep incisions. Between these rings there are longitudinal wrinkles and cracks. These furrows and cracks, in the coarser quills especially, give the bark a very rough or rugous character, by which it may generally be readily distinguished from the large quills of Huanuco or gray bark. The periderm is almost insipid. Its colour is naturally brown, but it is often rendered more or less silvery or gray by the crustaceous lichens with which it is covered.

The derm or uncoated portion consists chiefly of liber, whose taste is very bitter and but slightly astringent. Its transverse fracture is resinous externally, and fibrous internally. Externally it is brown, and is marked with impressions corresponding to the furrows or cracks of the periderm. Internally it is finely fibrous, and has a deep cinnamon-brown colour.

Fine large coated quills are sometimes selected for filling druggists' show bottles.

β . *Flat yellow bark* (*cinchona regia plana*). The pieces of this sort are from eight to fifteen or eighteen inches long; from one to three inches broad, and from one to five lines thick. They are but little curved or arched; occasionally the inner surface is slightly convex, and the outer one concave from drying. In general, the pieces are uncoated (*cinchona regia nuda*), and then consist almost solely of liber, which sometimes has a thickness of one-third or even half of an inch. This derm or liber has considerable density, usually a perfectly uniform texture, and on the external surface is marked by longitudinal digital furrows,² which are more or less confluent and separated from one another by projecting ridges. The colour of its external surface is slightly brownish tawny-yellow, frequently with blackish-red patches. The internal surface is fibrous, often with an undulating grain, of a yellowish tawny colour, sometimes with an orange tint, especially when the bark is fresh. The transverse fracture is purely and uniformly fibrous, the fibres being short and readily detached, and irritating the skin like the hairs of *Dotichos pruriens*. The longitudinal fracture is without splinters, and presents a surface covered with brilliant points, owing to the reflection of light from the detached fibres, and of a uniform colour. Its taste is very bitter—the bitterness being gradually developed on mastication, with scarcely any astringency.

2. *Dark Calisaya bark*—This is called *Colisaya zamba*, *C. negra*, or *C. macha* (sambo, black

Fig. 337.



Bark of *C. Calisaya* entirely deprived of periderm.

(This figure shows the digital furrows, and the short fibrous fracture of the liber.)

¹ It is not uncommon to find pieces whose periderm is four-tenths of an inch thick.

² Weddell calls them *sillons digitaux*, because they are somewhat like the impressions produced by the tips of the fingers on soft paste or clay. The Spaniards term them *conchas*, on account of their fancied resemblance to the hollows of certain shells.

or male *Calisaya*). It is remarkable for the dark tint of its external surface, which is often of a vinous black. Weddell met with it especially at Apolobamba, and in the province of Carabaya in Peru.

3. *Pale Calisaya bark*.—This is termed *Calisaya blanca* (white *Calisaya*). It is less unequal on the surface, sometimes semi-cellular, and of a paler colour.

DIAGNOSIS. *a. Physical.*—The periderm or coat is brown internally,¹ deeply furrowed or cracked transversely or circumferentially so as to form rings, wrinkled longitudinally, and, in the older branches, brittle and readily detached. The derm or liber is of a uniform orange or cinnamon brown; yields slowly, when masticated, an intensely bitter, very slightly astringent taste; and breaks with a fibrous fracture which is equal internally and externally. The external surface of uncoated flat pieces is marked by digital furrows.

Barks whose periderm is white or micaceous, or red, or which is devoid of the transverse or annular furrows or cracks, are not genuine *Calisaya* barks. Those barks whose derm or liber has an ochry or very red tint, or which presents two distinct colours (a whitish one internally and a reddish one externally), or whose fracture is more fibrous internally than externally, are suspicious.²

"The best characters," says Dr. Weddell, "by which the true *Calisaya* may be distinguished from every other species, are—the shortness of the fibres which cover the whole surface of its transverse fracture, and the facility with which they may be detached instead of being flexible and remaining adherent, as is the case with the barks of *rufinervis* and *scrobiculata*. Lastly, its uniform dull yellow (tawny) colour, and its substance not being marbled with white, readily distinguishes it from *C. Boliviana*."

"Add to these characters its great density (which is such that when a nail is drawn across it a bright mark is left): the depth of the digital furrows and the prominence of their separating ridges are generally sufficient to distinguish the flat *Calisaya* from all the other barks with which it may be mixed.

"The quilled *Calisaya* is more difficult to distinguish, because its periderm, in its physical characters, greatly resemble several other species, especially *scrobiculata* and *rufinervis*; and also because the fracture does not present the same clear characters which it does in the older barks." To these characters we must add the degree of bitterness, which, in doubtful cases, is the most sure method of deciding the question.

β. Microscopical.—"If we resort to the microscope to aid us," says Dr. Weddell, "the characters by which the bark is to be distinguished are very slight; namely, a slight excess in the thickness of the periderm, and the broader resinous circle." If we examine by the microscope a transverse section of this bark (see Figs. 338 and 339), we observe that the texture is homogeneous, and consists of ligneous fibres uniformly distributed in cellular tissue filled with resinous matter. This tissue is interposed between the fibres so as almost to isolate them. If we examine a longitudinal section of the liber (see Fig. 340), it will be seen that the ligneous fibres are short and fusiform, and their obliquely truncated extremities are only loosely adherent to, or are even completely independent of, those next to them.

γ. Chemical.—It is doubtful whether there are any chemical means of distinguishing this from other allied cinchona barks. Anthony³ gives the following: Digest one part of finely-cut bark in four parts of boiling distilled water for twelve hours; then filter. This infusion yields with reagents the following results: Dilute liquor ammoniæ (sp. gr. 0.990) renders it turbid, and occasions a precipitate: neither a solution of iodide of potassium (one part iodide and six parts water) nor a saturated solution of nitrate of baryta occasions any change in it: lastly, solution of fresh-made sulphate of protoxide of iron (one part sulphate and six parts water) colours the infusion green, but does not, within four hours, occasion any precipitate. According to Anthony, these results taken together characterize *Calisaya* bark, and distinguish it from all other cinchona barks.

Guibourt⁴ uses sulphate of soda to distinguish *Calisaya* from *Loxa* and *Limba* barks: Coarsely pulverize the suspected bark, and rub the powder in a mortar, so as to form a thin paste, which is to be placed on a filter. Add some crystals of pure sulphate of soda to the filtered liquor: if the bark be the *Calisaya* sort, a white precipitate is obtained; but if it be a gray bark this effect does not take place.

The following are the characteristics of *Calisaya* given in the *Pharmacopœia Londinensis* for 1851:—

"Thick, chiefly composed of very slender acute fibres, either flat or quilled: the external surface of the latter ash-coloured or brownish, wrinkled longitudinally, deeply fissured transversely or circumferentially: the former denuded for the most part, and of a cinnamon-brown colour. Very bitter. From a pound of this bark should be obtained, by means of sulphuric acid, about three drachms of disulphate of quina."—*Ph. Lond.*

CRYPTOGAMIA.—The following is a classified list of the cryptogamic plants found on this bark, according to Fée.⁵—

¹ Externally, it may be variously coloured by lichens.

² See, on this subject, Guibourt, *Journ. de Pharm.* t. xxii. p. 614, 1836.

³ Buchner's *Repertorium*, Bd. iv. S. 54, 1835; and Bd. vi. S. 58, 1836.

⁴ *Journ. de Pharm.* t. xxii. p. 614, 1836.

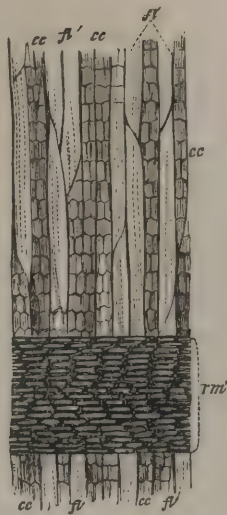
⁵ *Cours d'Histoire Naturelle*, t. ii. p. 262, 1828.

CINCHONA :—CALISAYA BARK.

Fig. 338.

Fig. 339.

Fig. 340.



Transverse section of the entire thickness of a piece of bark with a portion of the periderm attached.

Transverse section of a portion of the liber (much more highly magnified than in Fig. 338).

Longitudinal section of a portion of the liber made parallel to the medullary rays.

Microscopic structure of Calisaya bark.

pd, Portion of periderm.

l, Liber.

cc, Cellular tissue of the liber.

fl, Ligneous fibres of the liber (cortical fibres).

rm, Medullary rays.

1. Fungi.—*Hypochnus rubrocinctus*; *Triclinum Cinchonarum*.

The first of these fungi is frequently met with on quilled yellow bark. Its receptacle is irregular in shape, scarlet, with a whitish surface.

2. Lichenes.—The crustaceous or adherent lichens are: *Opegrapha peruviana*; *O. Scaphella*; *O. ovata*; *O. rhizocola*; *Graphis cinerea*; *G. Cinnaburina*; *Arthonia obtrita*; *Fissurina Dumastii*; *Chiodecton sphaerale*; *Trypethelium verrucosum*; *T. chiodectonoides*; *Pyrenula annularis*; *Porina americana*; *Ascidium Cinchonarum*; *Lepra flava*; *Variolaria amara*; *Lecidea aurigera*; *L. tuberculosa*; *L. soredifera*; and *L. punicea*.

The foliaceous lichens are: *Parmelia perlata*; *Sticta macrophylla*; *Collema azureum*; and *Solorina vitellina*.

The filamentous or hairy lichens are *Usnea florida* and *U. barbata*.

3. Hepaticæ.—*Jungermannia atrata*.

4. Musci.—*Hypnum Langsdorfii*.

COMPOSITION.—Deschamps¹ discovered in this bark the salt which he termed the *quinquate of lime*, but which is now called *kinate of lime*. In 1820, Pelletier and Caventou² analyzed this bark, and found in it *superkinate of quinine*, *kinate of lime*, *red cinchonic*, *soluble red colouring matter* (tannin), *fatty matter*, *yellow colouring matter*, *lignin*, and *starch*. At first, they thought this bark contained no other vegetable alkaloid than quinine, but they afterwards³ discovered cinchonia in it. In 1829, Sertürner⁴ announced the existence of a third alkaline base in it, to which he gave the name of *quinoidine*. In 1846, Liebig⁵ declared this to be *amorphous quinine*; and still more recently, Van Heijningen⁶ has resolved it into four or five different substances, of

¹ Ann. Chim. t. xlviii. p. 65.

² Ibid. t. vii. p. 302, 1821.

³ Lancet, p. 585, May 23, 1846; Ann. d. Chem. u. Pharm. Bd. lviii. S. 315, 1846.

⁴ Pharmaceutical Journal, vol. ix. p. 322, 1850.

⁵ Journ. de Pharm. t. vii. p. 89, 1821.

⁶ Buchner's Repertorium, Bd. xxxii. S. 95, 1829.

which one is a peculiar base called *quinindine*, or β -*quinine*, and another γ -*quinine*¹. Schwartz² has recently detected both *kinovic* and *cincho tannic* as well as *kinic acid* in this bark.

In 1827, Pelletier³ consumed 2,000 quintals of this bark in the manufacture of 90,000 ounces (French) of disulphate of quinine; this is about three drachms of disulphate for one lb. of bark. Soubeiran⁴ states that one lb. (French) of *uncoated yellow bark* yields three drachms and from 30 to 50 grains (French) of disulphate of quinine; while the same quantity of *coated yellow bark* yields three drachms (French) of the disulphate. It may be stated generally, that 100 parts of yellow or Calisaya bark yield from 3 to 3½ per cent. of crystallized disulphate of quinine; or, 2 lbs. avoird. of bark yield nearly 1 oz. avoird. of the crystallized sulphate. Assuming that this sulphate contains 74.3 per cent. of pure quinine, it follows that 100 parts of Calisaya bark contain from 2¼ to 2½ parts of pure quinine. I have heard that as much as 4 per cent. of disulphate of quinine has been obtained from one sample of Calisaya bark.

Puttfarcken⁵ states that this bark yielded him only 0.58 per cent. of ashes, being a smaller amount than he obtained from any other either genuine or false cinchona bark. The ashes were of a green colour (owing to manganate of potash). The percentage of carbonate of lime and of caustic lime in the bark were respectively (on the average) 0.45 and 0.25—proportions which were smaller than in any other cinchona barks examined, and seem to favour the notion that with the increase of the alkaloids in the barks the proportion of lime diminishes.

MEDICINAL PROPERTIES—Yellow or Calisaya bark, on account of the large quantity of quinine which it yields, possesses more powerfully tonic and febrifuge qualities than any other cinchona bark, red bark, perhaps, excepted. In the London Pharmacopœia of 1851, it has, therefore, been directed to be used as "*Cinchona*," when the particular sort is omitted to be specified in the preparation of *Decoctum Cinchonæ*, *Extractum Cinchonæ*, *Infusum Cinchonæ*, *Infusum Cinchonæ spissatum*, and *Tinctura Cinchonæ*.

Considered as an astringent, yellow bark is inferior to some other sorts of Cinchona, on account of its containing a smaller proportion of tannic acid (Pelletier and Caventou).

PSEUDO-CALISAYA BARKS.

Under this name I include various barks, both quilled and flat, which are more or less allied to or simulate the genuine Calisaya sort, and are known to the dealers as *false* or *spurious Calisaya barks*. They are imported from Bolivia and Peru, and, except in one instance (that of *C. scrobiculata* var. β *Delondriana*), are not known to the London dealers by any special names to distinguish them from one another. In France, the term *Calisaya léger* (light or flimsy Calisaya) has been applied to some of them. From Germany, I have received one of them (*C. micrantha*) under the name of *cortex chinæ pseudo-regius*. From Sweden I received, as a genuine Calisaya bark, the bark of *C. amygdalifolia*. I have very little doubt, therefore, that on the Continent, as well as in this country, they frequently pass as the genuine Calisaya sort.

They are imported either alone or intermixed with genuine Calisaya bark. The intermixture, says Dr. Weddell, is especially made in Bolivia with the barks of *C. Boliviana* and *C. ovata* var. β *rufinervis*; and only on the coast with *C. scrobiculata*.

Under the general head of Pseudo-Calisaya barks I include—

1. The barks of *C. Calisaya* var. β *Josephiana* and of *C. Boliviana*; the former perhaps strictly entitled to the name of a genuine Calisaya bark, and the latter bearing the name of Calisaya bark in Bolivia.

2. The barks of *C. ovata* var. β *rufinervis*, *C. micrantha*, *C. amygdalifolia*, and *C. scrobiculata* var. α *genuina* and var. β *Delondriana*.

M. Guibourt mentions several other barks (for example, *C. pubescens* var. α *Pelletieriana*, and *C. cordifolia*) as being used for adulterating the Calisaya sort. But inasmuch as they differ considerably in appearance from the latter, and are distinguished in trade, by *Cusco bark* (*Curthagen bark*), special names, as distinct sorts, I have not included them under the general head of Pseudo-Calisaya barks, but shall describe them separately hereafter.

1. *C. Calisaya* var. β *Josephiana*.

BARK OF C. JOSEPHIANA.—The shrub called by the Peruvians *Ichu-cascarilla*, which yields this bark, being considered by Weddell to be a variety of *C. Calisaya*, its bark must rank as a sort of Calisaya, though in appearance it differs considerably from the genuine Calisaya bark. The bark both of the stems and of the wood is found in commerce.

1. *Stem bark*.—Weddell observes of it, that though it rarely occurs in commerce, yet by the natives it is used as often as any other bark, in consequence of the facility with which it is procured. Its periderm (or coat), he adds, is brown or blackish-gray, or slate-coloured (a colour

¹ *Pharmaceutical Journal*, vol. xi.

² *Dict. Mat. Méd.* t. v. p. 603.

³ *Pharmaceutical Journal*, vol. xi. p. 129, 1851.

⁴ *Ibid.* vol. xii. p. 17, 1851.

⁵ *Traité de Pharm.* t. i. p. 583.

common to all cinchona barks developed under the influence of wind and sun), and is covered by pale elegant lichens. As the bark adheres strongly to the wood, it is separated with difficulty from the latter; and to this circumstance is to be attributed the fact that the internal surface of this bark is often torn. The cinnamon-like *Calisaya* quills before alluded to (p. 645) are exactly like some recently sent to Dr. Weddell as *Ichu-Cascarilla*.

2. *Root-bark*.—Weddell was shown, in Peru, the bark obtained from the larger roots, or rather stumps, of *C. Josephiana*. He describes it as being in short, flattened, undulated, or more or less contorted pieces, deprived of the periderm, fibrous or almost smooth on the inner surface, very slightly cellular, externally of a uniform ochre-yellow colour, and decidedly bitter, but less intensely so than good *Calisaya*, whose internal structure it possesses the characters of.

Weddell suggests that this root will become valuable, notwithstanding the difficulty of collecting it, as it is superior to some of the barks at present in use, and has not hitherto been much employed. A root-bark, apparently the one in question, has been imported into England by way of the Pacific, and found to yield quinine, but in very small quantity.

New Granada Cinchona root-bark.—There is a root-bark of a species of cinchona imported from New Granada by way of Santa Martha and Maracaibo, which must not be confounded with the root-bark of *C. Josephiana*. In its curly or twisted or contorted character, it much resembles the latter; but it yields cinchonine—whereas the root-bark of *C. Josephiana* yields quinine.

2. *C. Boliviana*.

CORTEX CINCHONÆ BOLIVIANÆ. Weddell; *Calisaya morada*, Boliv.; *Cascarilla verde morada*, Peru; *Bark of the Mulberry-coloured Calisaya*.—This constitutes part of the *Calisaya* bark of commerce. Its occurs both quilled and flat, and resembles the genuine *Calisaya*, from which it is with difficulty distinguished; but its fibre is somewhat coarser, and more easily reduced to powder. Its taste is bitter, with a somewhat smoky flavour. The fractured surface presents, when quite fresh, paler or whitish patches, which, however, become at first red and afterwards brownish-yellow in the air. The periderm or coat is less thick, and its fissures less marked than in the genuine *Calisaya*. *Quilled Boliviana bark* is quite similar to quilled *Calisaya*. *Flat Boliviana bark* is composed solely of liber. It is in general equally dense but thinner than flat *Calisaya*. The digital furrows are shallower, a little more confluent, and the separating ridges more rounded. Its colour is brownish fawn yellow, with somewhat greenish tints in some places.

3. *C. ovata* var. *β rufinervis*.

CORTEX CINCHONÆ RUFINERVIS; *Cascarilla Carabaya*; *Cascarilla zamba morada*, Peruv.; *Dark Mulberry coloured Calisaya*.—Dr. Weddell states that in the province of Carabaya, where this bark is collected, it is habitually used to sophisticate *Calisaya* bark, from which it is frequently very difficult to distinguish it. In the quilled variety, called by Dr. Weddell *pseudo-Calisaya*, the periderm exfoliates very readily. The flat pieces consist either of liber only, or of liber with a portion of the cellular coat. The fibre is finer and closer than the *Calisaya* sort; and the external surface presents darkish spots due to the remains of the cellular crust filled with a brown juice. "I have seen," says M. Guibourt, "a manufacturer of sulphate of quinine complain much at having been deceived by the appearance of this bark."

4. *C. micrantha*.

CORTEX CINCHONÆ MICRANTHÆ.—By the inhabitants of Huancuco it is called *Cascarilla provinciana*; in the province of Carabaya, it is termed *Cascarilla motosolo*, and, by the Bolivians, *Quepo-Cascarilla* or *Cascarilla verde*. In Carabaya, where it is extensively collected, it is confounded with the ordinary forms of *C. ovata*, under the name of *Cascarilla morada ordinaria*.

It is obvious to me that either this bark puts on several very dissimilar forms, or that the barks of several distinct species are confounded together under the same name. M. Guibourt appears also to have arrived at a somewhat similar conclusion; for, after describing two sorts of *micrantha* bark, he observes that it appears to him that they are not the produce of Poeppig's *micrantha*, which, therefore, cannot be identical with that of Weddell.

The quilled *micrantha* bark, according to the statements of Poeppig and Reichel, constitutes part of the Huancuco or gray bark of commerce. Its characters, as given by Weddell, are as follows: periderm very thin, adherent, slightly wrinkled longitudinally as if shrivelled, or very slightly warty, bright brownish-gray, marbled with some deeper tints. Derm almost smooth externally, finely fibrous, and of a bright orange fallow internally. Transverse fracture short externally, fibrous internally. Bitterness very marked and rapidly developed. (See also p. 655).

The flat *micrantha* simulates genuine *Calisaya*, but is less dense. It consists either of liber only, or of the liber and cellular tissue; the latter is usually semi-fungous and imperfectly ex-

foliated. The external surface frequently presents concavities or superficial digital furrows like those of *Calisaya* bark, and separated by irregular suberous elevations; much more rarely smooth by the persistence of the whole of the cellular coat; of a grayish and bright orange yellow colour. Internal surface is remarkably fibrous,¹ and of a brighter tint than the external one. Transverse fracture stringy throughout the whole thickness of the bark—or somewhat suberous externally. Longitudinal fracture a little splintery, with a dullish surface. Taste very bitter, speedily developed, a little piquant, scarcely styptic.

In rather aged barks, Weddell observes that the periderm is not very thick, and appears to be entirely formed of the suberous coat; but between this external layer and the derm there is frequently found a reddish pulverulent matter, of which it is in part made up, and which results from the decomposition (not desquamation or exfoliation, as in other species) of this part.

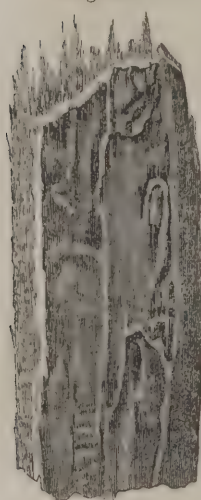
Poeppig says that three kinds of *micrantha* bark are known in trade; but he does not specify them.

M. Guibourt includes Weddell's flat *micrantha* bark under his *orange yellow bark* (*quinquina jaune orangé*), and observes that its exterior surface is, as it were, greenish, is marked with transverse impressions and oval cavities filled with some fungous matter, and presents asperities and inequalities not met with in any other sort.

5. *C. scrobiculata*.

CORTEX CINCHONÆ SCROBICULATÆ.—The barks of the two varieties of *C. scrobiculata* are not distinguished by Weddell; but the specimens which I have in my possession are very distinct.

Fig. 341.



Bark of *C. Scrobiculata*.
Stringy fracture of liber.

If we examine a piece of flat *scrobiculata* bark, we shall find, says Dr. Weddell, that instead of the digital furrows with a fibrous bottom, which characterize *Calisaya* bark, it presents a surface almost even, and consisting of cellular tissue, traversed here and there by a slight linear impression; the inner surface being, as in *Calisaya* bark, of a fibrous texture. The transverse fracture is more or less suberous or fungous externally, according to the thickness of the cellular coat; and very fibrous or stringy internally; the fibres being long and pliant.²

When a transverse section of the bark is submitted to microscopic examination, we observe that the fibres are more numerous than in *Calisaya* bark, and are nearer the inner surface; but they lessen in number rapidly towards the outer or epidermoid surface, and the outermost layer is almost devoid of them. To this circumstance is due the fact that the transverse fracture is more fibrous internally than externally (Fig. 341). The cortical fibres, instead of being free or isolated, in the midst of cellular tissue, touch each other, and adhere by one of their surfaces with neighbouring fibres to form parallel series (Figs. 342 and 343); and if we examine a longitudinal section (Fig. 344) of the liber by the microscope, we observe that these fibres are nearly twice as long as those of *C. Calisaya* (Fig. 340), and their extremities are always attached to those of neighbouring fibres, so that the oblique truncations are more elongated (Fig. 344). To this peculiarity of the fibres is due the more fibrous or stringy transverse fracture of this bark.

1. *Cortex C. scrobiculatæ* var. *α genuina*.—This bark is called in Peru *Cascarilla colorado del Cuzco* (i. e. Red Cuzco Bark), or *Cascarilla de Santa-Ana* (i. e. St. Ann's Bark). This is one of the barks which Guibourt terms *Calisaya léger* (i. e. Light or Flimsy *Calisaya*). I have met with it in English commerce under the name of *Cusco bark*. It occurs in flat pieces composed of the liber covered externally by a thin layer of the cellulo-resinous tissue. My specimens are readily distinguishable from *Calisaya* bark by their fresher or brighter colour; but Weddell states that the colour of this bark is very variable. The external or cellulo-resinous surface is brick-red or purplish red, or within reddish-orange; marked by superficial transverse impressions or furrows. The internal surface (of the liber) is of a fine reddish orange colour. Fracture more or less short or suberous externally, according to the thickness of the cellular coat: fibrous or stringy internally; the colour of the fractured surface is not uniform. Taste both astringent and bitter. The reddish colour of this bark explains why it is called *red bark* (*Cascarilla colorada*) in Cuzco, and why De Candolle thought *C. scrobiculata* was the source of the red bark of commerce. Guibourt states that if this bark be isolated in a bottle it evolves an

¹ The fibrous grain of some of the flat pieces is remarkably wavy or undulating.

² The best method of rendering these fibres evident is to effect the fracture by torsion (Weddell).

agreeable raspberry-like odour. This bark is imported both unmixed and mixed with Calisaya.

2. *Cortex C. scrobiculata* var. *β Delondrianæ*.—This bark is imported from Lima, and is known

Fig. 342.

Transverse section of the bark completely deprived of its periderm.

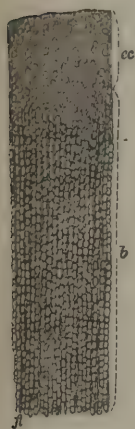


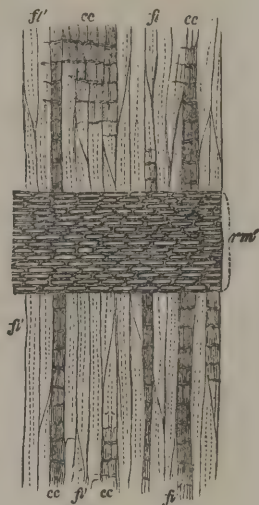
Fig. 343.

Transverse section of the liber (more highly magnified.)



Fig. 344.

Longitudinal section of *C. scrobiculata*, parallel to the direction of the medullary rays.



Microscopic structure of the bark of *C. scrobiculata*.

Fig. 342 shows the analogy which exists between the external layer (*cc*) of this bark, and the internal layer of the periderm of the Calisaya bark (Fig. 338).

cc, Cellular tissue of the liber.
cc, Cellular envelop.
fi, Ligneous or cortical fibres of the liber.
fi', Medullary rays.

in English commerce by the name of *Peruvian Calisaya*. It occurs in flat pieces which in colour closely resemble the genuine Calisaya bark, for which it is often passed off. They are thicker and denser than the *Cascarilla de Santa Ana*, from which they also differ in colour. Externally, this bark is smoother than the Calisaya bark, and the ridges between the furrows are smoother and rounded, not sharp, as in the bark just mentioned. The fracture is fibrous; the taste, in the larger pieces, less bitter than that of Calisaya bark.

The younger quilled and coated *scrobiculata* bark probably constitutes part of the crown bark of commerce, with which it agrees in chemical constitution.

Weddell states that 1000 parts of the *scrobiculata* bark yield only from 7 to 8 parts of sulphate of cinchonine, and from 3 to 4 parts of disulphate of quinine; and he adds that the large quantity of red colouring matter which it contains is a great impediment to its use for manufacturing purposes.

6. *C. amygdalifolia*.

CORTEX CINCHONÆ AMYGDALIFOLIÆ; *Cascarilla-Echenique*, Peruv.; *Cascarilla-Quepo*, or *Quepo-Cascarilla*, Boliv.—It is imported, either alone or mixed with other Bolivian barks, both quilled and flat. It is distinguished from genuine Calisaya bark by its lightness, its more orange colour, the presence of the persistent cellular coat in the so-called uncoated pieces, the more stringy transverse fracture and the splintery longitudinal fracture of the liber, the want of very marked annular cracks on the periderm, and the styptic usually not very bitter taste. The flat pieces consist of liber and cellular coat, oftentimes more or less covered by the periderm; externally it is smooth, or superficially wrinkled longitudinally by drying. A portion of the quilled sort, which had been identified by Dr. Weddell, yielded Mr. J. E. Howard 7 parts of quinine and a trace of cinchonine in 1000 parts of bark. The flat pieces yielded him 2.3 parts of quinine, and the like quantity of cinchonine, in 1000 parts of bark.

II. CORTEX CINCHONÆ DE CARABAYA.—CARABAYA BARK.

Carabaya or *Carabaya bark* was first imported into London in 1846. Its name would lead to the suspicion that it was obtained from Weddell's *Cinchona carabayensis*: but such is not the case. According to information furnished by Dr. Weddell to Mr. J. E. Howard, it is the produce of *Cinchona ovata* var. *a vulgaris*. "Dr. Weddell assured me," says Mr. Howard (in a letter to me), "when here this spring [1852], that it was var. *a vulgaris*, and his specimens given me include it. The *rufinervis* bark, which he has also given me, is a distinct variety." It is obvious, however, that Carabaya bark is very different in appearance, and even in chemical composition, from the bark usually known as the produce of the ordinary variety of *C. ovata*. Moreover, in Peru, the name of *Cascarilla Carabaya* is given to *C. ovata* var. *β rufinervis*: so that the designation of "Carabaya bark" is not a very precise one. I apply it, however, exclusively to the bark known by this name in the London market, and which is tolerably uniform in its properties.

Carabaya bark is imported from Islay, the nearest port to the province of Carabaya, in which the bark is collected. Large importations of it are now made into London.

It is essentially a thin, flimsy bark, of a more or less rusty colour; some of the pieces resembling in appearance *Huamalis bark*, from which, however, it appears to be essentially different. The quills are about the thickness of the finger, and of variable length. I have some which are two feet long; some are coated, others are uncoated quills. The coated quills (*coated Carabaya quill*) have a dull, rusty or grayish rusty, warty coat, marked by longitudinal furrows, but rarely by transverse furrows or cracks. Some of the uncoated quills have a dark or more or less tea-green tint (*tea-green Carabaya quill*). The flat pieces (*flat Carabaya*) consist either of liber only, or of liber with a portion of the cellular coat. The external surface of the liber, in some of the uncoated pieces, is blackish, with rusty round flattish warts. In some cases the dark external surface looks as if it had been dusted over with a yellowish powder (e. g. powder of gamboge or turmeric), by which a kind of bloom has been given to it. The colour of the liber is usually more or less orange; but some pieces resemble in colour red bark (*red Carabaya bark*). Carabaya bark is used by the manufacturers of sulphate of quinine as a cheap substitute for the more valuable Calisaya bark. The total amount of alkaloids (cinchonine, quinidine, and quinine) which it yields, is from three to four per cent.

III. CORTEX CINCHONÆ DE CUSCO.—CUSCO BARK.

Under the name of *Cusco* or *Cuzco bark*, I have met with, in English commerce, several very distinct barks, viz. 1st. The bark of *Cortex Cinchonæ scrobiculata* var. *a genuina*, known in Peru as Red Cusco bark, and which has already been noticed (see *ante*, p. 650). 2dly, The bark of *Cortex pubescens* var. *a Pelletieriana*. As the last-mentioned bark is the one which was first known in Europe as Cusco bark, and which is usually indicated by this designation in pharmaceutical works, I shall continue to call it by this name. 3dly, I have also received under the name of "Cusco bark," specimens of a quilled bark, and also of a flat bark, which I believe to be the produce of *C. ovata* (see *Cortex Cinchonæ de Jaen*).

Cusco bark, or the bark of *C. pubescens* var. *a Pelletieriana*, was first introduced into Europe in 1829 as yellow or Calisaya bark. It appears to have been imported at about the same time into England, Hamburg, and Bordeaux.¹ Bergen² called it *rusty bark* (*China rubiginosa*), on account of its rusty yellow colour. The bark described in 1829 by Pelletier and Coriol,³ under the name of *Arica Bark* (*écorcé d'Arica; quinquina d'Arica*), is a variety of it.

Weddell has ascertained that this bark is the produce of *Cinchona pubescens*. The var. *a Pelletieriana* yields Pelletier's *Arica bark*, which, by the Bolivians and Peruvians, is called *Carua-Carua* or *Cargua-Cargua*, and in Carabaya it is sometimes termed *Cascarilla amarilla* or *Quina amarilla* (yellow bark), the name which Mutis gave to the bark of *C. cordifolia*. The bark of var. *β purpurea* is called, in the valleys about Huanuco, *cascarilla bobo de hojas moradas*, or "spurious bark with mulberry leaves."

The bark of *C. pubescens* is never entirely devoid of its external cellular coat; and hence, when fractured transversely, this coat breaks smooth or corky, while the liber presents a short fibrous or ligneous fracture. In this bark the periderm consists only of some rows of the cubical cells of the suberous coat. If we submit sections of the bark to microscopic examination, we observe that the portion of the suberous coat which remains adherent to the bark is membraniform, and consists of cubical or rectangular cells (Fig. 346 s). The limits of the cellular envelop

¹ Jobst. Buchner's *Repert.* Bd. xxxii. S. 464, 1829; Guibourt, *Journ. de Chem. Méd.* t. vi. p. 333, 1829.

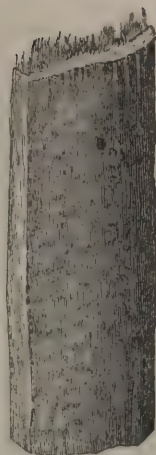
² Buchner's *Repert.* Bd. xxxviii. S. 9, 1839.

³ *Journ. de Pharm.* t. xv. p. 565, 1829; also, *Ann. de Chim. et de Phys.* t. li. p. 154.

and the liber are less clearly defined in this bark than in the others before figured. The cells of the cellular envelop, however, are more flattened in the direction from without inwards than those of the liber. The greater part of the transverse section (Fig. 346) of the bark is seen to consist of cellular tissue, in which the fibres form but a small number of irregular and concentric series in the inner half of the bark. A very remarkable circumstance is the size of the fibres, which are frequently three or four times as large as those of *Calisaya* or *scrobiculata* bark before figured (see *ante*, Figs. 338 to 344). Bundles of these fibres, united together laterally, are arranged in zones in the midst of the cellular tissue of the bark (Figs. 347 and 348).

Bergen observes, that Cusco bark somewhat resembles what is called fibrous Carthagena bark. It varies in appearance according to its age; but in general its orange-red or rusty colour, the remains of the white or grayish suberous coat, and the absence of transverse cracks, serve to distinguish it. The young quills are coated, thin, externally smooth, and of an almost uniform yellowish-gray colour; on the inner surface they are yellowish, and have a fibrous texture. The middling-sized quills are covered by a whitish, smooth, uncracked, suberous coat, beneath which is an orange-red cellular envelop. The inner surface of the liber is dull yellowish cinnamon brown. The cortical fibres are coarse and pale, but become red by exposure to the air. The larger and flat pieces consist of the liber covered externally by the cellular envelop, with the remains of some portion of the suberous coat. By inexperienced persons they may be mistaken for yellow (*Calisaya*) bark. "They may be readily distinguished," says M. Guibourt, "by their more regularly cylindrical form, by their smoother external surface, by the remains of the white and fungous layer, by their two tints of colour, orange or brownish externally, almost white or very pale internally, and, lastly, by their not occasioning any precipitate with sulphate of soda."

Fig. 345.



Bark of C. pubescens coated externally by periderm.

Smooth or suberous fracture of the external or purely cellular portion of the bark.

Ligneous fracture of the internal portion or liber.

Fig. 346.

Transverse section of the bark of *C. pubescens*.



Fig. 347.

Transverse section of the liber of *C. pubescens* (more highly magnified than in Fig. 344).

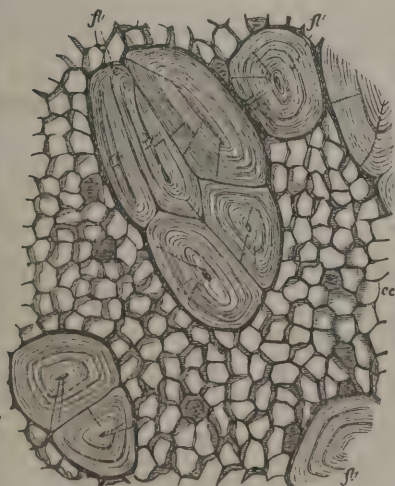
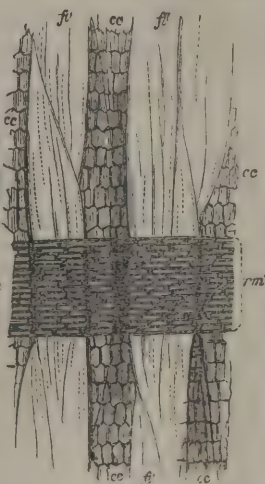


Fig. 348.

Longitudinal section of the liber of *C. pubescens*.



Microscopic structure of the bark of C. pubescens.

s. Suberous coat.
cc. Cellular envelop.
l. Liber.

cc. Cellular tissue of the liber
ff. Ligneous or cortical fibres of the liber.
rm. Medullary rays.

This bark was analyzed by Frank,¹ who obtained, in one experiment, 48 ounces of cinchonine, and a trace of quinine, from 100 lbs. of bark. In another trial, he procured 50 ounces of cinchonine from the same quantity of bark. Winckler² reports, that he got 256 grains from 16 ounces of the best heavy sort of *rubiginosa* bark, and only 77 grains from the same weight of an inferior sample of the bark. M. Guibourt³ examined a kilogramme (about 2 lbs. 3 oz. avoird.) of Cusco bark, and estimates the quantity of cinchonine contained in it at one drachm for every pound of bark. He observes, that the bark is very rich in red cinchonine. Some of the pieces, according to Bergen, are very rich in resin.

ARICA BARK; *Ecorce d'Arica*, Pelletier; *Quinquina d'Arica*. The bark which, in 1829, Pelletier and Corriol analyzed under this name, appears to be essentially Cusco bark. It differs, however, says M. Guibourt, a little from the ordinary Cusco bark, though it constitutes a part of it. According to Pelletier, Arica bark becomes deep green when touched by nitric acid, and yields, on analysis, an alkaloid (*aricina*), which acquires an intensely green colour when dissolved in concentrated nitric acid, and which forms, with sulphuric acid, a sulphate, not crystallizable from its aqueous solution, but forming a white, trembling, gelatiniform mass. In 1830, I procured from M. Pelletier a specimen of his Arica bark (which is now in the Museum of the Pharmaceutical Society), but it is not rendered green on the application of nitric acid. "The bark analyzed by Pelletier," says M. Guibourt,⁴ "does not become coloured by nitric acid; and I am now at liberty to state, that Pelletier, having requested me to return him the greater part of the Arica bark which he had previously given me, in order that he might verify the characters which he no longer found in that which remained with him, obtained only negative results, which left him in great doubt as to the peculiar nature of aricina."

CORTEX CINCHONÆ PURPUREÆ; *Cascarilla boba de hoja morada*. (Spurious bark with purple leaves).—This is the bark of *Cinchona pubescens*, var. β *purpurea*, Weddell. Reichel⁵ has declared that the bark of this tree, which Poeppig brought to Europe, is identical with the Huamalies bark of commerce. But I am satisfied that this is a mistake. For in the first place, Martiny,⁶ who also received a specimen of the bark from Poeppig, has declared that it has not the most remote resemblance to Huamalies bark; and in the next place, the barks of *C. purpurea*, in Pavon's collection in the British Museum, as well as those brought by Weddell, are entirely different from Huamalies bark, but agree with the description given of them by Ruiz in the *Quinologia*.

The genuine bark of *Cinchona purpurea* has some resemblance to that of *C. cordifolia*. The quills have a rigid fibre, are somewhat warty, and have a smooth, light gray epidermis, somewhat like that of *Cusparia* bark. They are almost entirely devoid of transverse cracks. The colour of the inner surface of the bark (liber) is cinnamon-brown. The coarser bark of the trunk is dark brown, with patches of the grayish epidermis adherent to it. In 1849, a considerable quantity of this bark, mixed with others, was imported.

The thick coarse bark yielded Mr. J. E. Howard in 100 parts only 0.85 of impure quinine, and 0.60 of cinchonine.

Considered in a medicinal point of view, all the above three sorts of bark are of inferior quality. Poeppig says that the bark of *C. purpurea* may probably be found useful for making cheap decoctions, as it can be sold at a very low price.

IV. CORTEX CINCHONÆ DE HUANUCO.—GRAY OR SILVER CINCHONA.

SYNONYMES.—*Quinquina de Lima*, Guibourt; *China Huanuco*, Graue *China*, Bergen; *China Huanuco*, *Yanuco*, *Guanuco*, *Havane*, Goebel; *Cascarilla provinciana*, Pöppig; *Cinchona cinerea*, Ph. Ed.

The appellations of *gray* or *silver* applied to this bark refer to the colour given to the bark by the thallus of various crustaceous lichens (*Graphidea*).

HISTORY.—This bark was first known in Spain in 1799. One hundred and eighty chests of it were brought to Santander, in that year, by the frigate *La Veloz*; and Ruiz was appointed to examine the cargo. He found in the chests a thick bark, till then unknown to the botanists of Peru, mingled with the barks of *C. nitida* and *C. lanceolata*, and with those of the species which Tafalla has designated by the phrase "*similar to Calisaya*."⁷ Pöppig⁸ says the trade in the barks of Huanuco commenced in 1785; but that in 1815 it almost entirely ceased. The scarcity of yellow bark will be likely again, I should think, to give a fresh impulse to it, as the quality of good Huanuco bark is excellent.

BOTANY.—It is unnecessary to detail the speculations of botanists as to the origin of this bark previous to Pöppig's discovery. This celebrated traveller brought to Europe a bark called

¹ Buchner's *Repertor*. Bd. xxxiii. S. 353. 1830.

² *Journ. de Chim. Méd.* t. vi. p. 353. 1830.

³ Hooker's *Companion to the Botanical Magazine*, vol. i. p. 252. 1835.

⁴ *Encyclop. d. Méd. Pharm. Naturalien und Rohwaarenkunde*, Bd. I. s. 381, 1843.

⁵ Laubert's *Memoir*, in Lambert's *Illustr. of the Genus Cinchona*, p. 78.

⁶ Hooker's *Comp. to the Bot. Mag.* vol. i. p. 244, 1835.

⁷ *Ibid.* 2te Reihe, Bd. xxv. S. 34, 1842.

⁸ *Hist. des Drogues*, 4me edit. t. iii. pp. 160—161.

Cascarilla provinciana, and which was the produce of *Cinchona micrantha*. Reichel, an apothecary at Hohenstein in Saxony, examined and carefully compared it with his own collection of cinchona barks, as well as with that of Von Bergen at Hamburg, and declared it to be identical with the *Huanuco bark* of commerce.

But under the name of Huanuco or gray bark two distinct barks are found in English commerce—one of which is the produce of *C. micrantha*, the other probably of *C. nitida*.

COMMERCE.—Gray bark is collected in Cuchero and Huanuco, and is conveyed to Lima, from whence it is exported to Europe. It comes over in chests, and also in serons.

DESCRIPTION.—Gray bark always occurs in the form of quills, which are usually coated. Two sorts are distinguished in English commerce—one as *fine gray bark*; the other as *coarse* or *inferior gray bark*. These sorts usually come over mixed, but sometimes separately. At a sale of gray bark, in April, 1852, Mr. J. E. Howard found the proportions to be as follows: 30 chests of unmixed fine gray, 30 to 40 chests of almost all inferior gray, and 100 chests of fine gray mixed with inferior gray.

J. FINE GRAY BARK; *China Huanuco*, Goebel, Pharm. Waarenk. Taf. vii. Figs. 1 to 4; *Quinquina rouge de Lima*; Guibourt; *La [Cascarilla] Peruviana* or *Quina cana legitima*, Laubert, Bull. Pharm. t. ii.—Mr. J. E. Howard regards this bark as the produce of *C. nitida*, R. and P., for it agrees with the bark of this species in Pavon's collection, and its description answers to that given in the Quinologia, and by Laubert, of the bark of *C. nitida*. The length of the quills is from three to fifteen inches; their diameter from two lines to one and a quarter, or even two inches; their thickness one-third of a line to five lines. At the edge of most of the perfect quills we distinctly observe a sharp oblique cut, made probably to loosen the bark. These oblique cuts are rarely found on other barks. The quills are frequently somewhat spirally rolled. We observe on the epidermis numerous short, irregular, transverse cracks; but they do not form rings, as in the Loxa or crown bark, and their edges are flat, scarcely separated or everted. The colour of the outer surface is clear or silvery gray, or whitish; in the smaller quills it is a uniform whitish gray, while in the large quills we observe a kind of cretaceous covering, owing to the thallus of some crustaceous lichens. The structure of the inner surface of this kind of bark is, in the small quills, smooth; in the larger ones fibrous: the colour is rather reddish, or rusty brown, than cinnamon brown. The fracture is smooth and resinous; the odour clayish or sweet, and which Bergen says is peculiar to this kind. The taste is astringent, aromatic, and bitter, but not disagreeable; the powder of a deep cinnamon brown. Mr. J. E. Howard, in drawing a parallel between the fine gray (or *nitida*) bark and the inferior gray (or *micrantha*) bark, describes the former bark as having been when fresh "very fleshy," thicker, and not wrinkled longitudinally. The external colour of its derm varies from maroon to rusty, and of its periderm (where not covered with lichens) of a more or less deep brown. The substance of the bark is red. In microscopic structure this sort approximates to Calisaya bark. The decoction of fine gray bark becomes turbid on cooling and deposits an abundant sediment. The resinous circle, which is very distinctly seen in this bark, "is connected," observes Mr. Howard, "with the constitution of the bark, as indicated by various chemical reagents, which, so far as I have made experiments, concur in showing that it is rich in all the usual constituents of the sap of the cinchona; whilst the predominant feature is the abundance of the tannin." On analysis this bark yielded him 2.113 per cent. of alkaloids; namely, quinine 0.571, quinidine crystallized 0.142, and cinchonine 1.4.

2. INFERIOR OR COARSE GRAY BARK: *Quinquina de Lima gris brun*, Guibourt; *Cascarilla provinciana*, Poeppig.—This is the bark of *C. Micrantha* (see ante p. 649). It has been well described by M. Guibourt as follows: "Bark in the form of long tubes, well quilled, of the size of a writing-quill to that of the little finger, very frequently wrinkled longitudinally by drying. The external surface is, moreover, moderately rugous, often almost devoid of transverse fissures, having a general deep-gray tint, but with black or white spots, and bearing here and there the same lichens as those found on Loxa barks. The liber is of a deep-brownish yellow, and as if formed of agglutinated fibres. The taste is bitter, astringent, acidulous, and aromatic: the odour, that of good gray barks."

Mr. J. E. Howard, in comparing this bark with the fine gray sort (*C. nitida*), describes it as being woody or finely fibrous, thinner than the *nitida* bark, wrinkled longitudinally, glaucous externally (both as regards the derm and epiderm), rusty yellow internally, and approximating to the *scrobiculata* bark in its microscopic structure (see ante, p. 650). Its decoction he finds to be pale, and to give a small flocculent deposit on cooling. In reducing this bark to powder, its woody character is very marked. Mr. Howard analyzed a specimen of this bark, and found that it yielded 1.773 per cent. of alkaloids—namely, quinine, 0.243; quinidine, 0.28; and cinchonine, 1.25.

CRYPTOGAMIA.—Mosses and Jungermannias are never found on this bark. Foliateous lichens are much more scarce than on Loxa bark. The following is Fée's list of the Cryptogamia:—

Lichenes.—*Opographa Ruiziana*; *O. Condaminea*; *O. rugulosa*; *O. tumidula*; *Graphis Acharii*; *G. serpentina*; *Arthonia confuens*; *A. divergens*; *A. obtrita*; *Trypethelium variolosum*; *Pyrenula marida*; *P. myriocarpa*; *P. mollis*; *Verrucaria nitens*; *V. theioplaca*; *Ascidium Cinchonarum*; *Leidea tuberculosa*.

COMPOSITION.—I am unacquainted with any complete analysis of gray barks, though their alkaloid strength has been determined several times. But until the analyses, above quoted, of Mr J. E. Howard, no one had determined the comparative quantity of alkaloids in the two kinds of gray bark above described. Soubeiran¹ states, that one pound of *Gray Lima Cinchona* yields a drachm and a half of sulphate of cinchonia, but he omits all mention of quinine.

The following are the quantities of pure cinchona and quinine in this bark, according to the undermentioned authorities:—

In one pound of Bark.			
	<i>Cinchonia.</i>		<i>Quina.</i>
Von Santen	from 74 to 210 grains.		0 grains.
Michaelis	{ finest sample 50 "		32 "
	{ second sample 74 "		28 "
Goebel and Kirst	168 "		0 "

Winckler² obtained 190 grs. of cinchonia from 16 ounces of strong, middling-sized quills.

According to Puttfarcken,³ Huamco bark yielded, on an average, only 1.6 per cent. of ashes, the colour of which he describes as being, in different samples, dark green, greenish, green, and gray.

MEDICINAL PROPERTIES.—It must be obvious, from the results of Mr. J. E. Howard's analyses, that the fine gray bark must possess more medicinal activity than the inferior or coarse gray sort, because the total amount of alkaloids (especially of quinine) which it contains is larger.

Good gray bark is, medicinally speaking, a valuable sort of cinchona. Ruiz and Pavon state that the *nitida* bark (which I believe to be the fine gray sort) is less nauseous and disagreeable to sick persons than other kinds of bark. The *micrantha*, or inferior gray bark, is more nauseous, on account of the greater preponderance of cinchonine which it contains.

V. CINCHONA HUAMALIES.—HUAMALIES BARK.

SYNONYMES.—*Quinquinas de Huamalties*, Guibourt; *Quinquina Havane* of French commerce; *China Huamalties*; *Braune China*, Bergen; *China Huamalties*, *Guamalties*, seu *Abomalties*, Goebel; *Braune China*; *China Huamalties*; *China fusca*, Geiger.

HISTORY.—It is not known precisely when this kind of bark first came into Europe. Von Bergen thinks that it probably was introduced simultaneously with *silver bark*, at the end of the last or commencement of the present century. In 1803, it was frequently carried direct from Lima to Hamburg. This bark is not used as a distinct kind in this country, and hence most druggists are unacquainted with it; but it is bought by some of our merchants for the foreign markets, especially for Germany.

BOTANY.—According to Reichel,⁴ who examined Poeppig's samples, the *Huamalties* bark of commerce is identical with the *Cascarilla boba*; and, therefore, is the produce of *Cinchona pubescens* var. β *purpurea*, Weddell. But several reasons lead me to believe that this inference is not correct. 1stly. *Huamalties* bark is not identical with the bark of this species contained in Pavon's collection in the British Museum, nor with that brought over by Weddell. 2dly. Dr. Julius Martiny,⁵ who obtained specimens of Poeppig's bark, declares that *Cascarilla boba*, given to him by Poeppig, does not resemble *Huamalties* bark; and I can confirm his statement, as he kindly sent me a small sample of the *Cascarilla boba*, which is now in the Museum of the Pharmaceutical Society. 3dly. The bark of *Cinchona purpurea* is very poor in alkaloids, while *Huamalties* bark is comparatively rich. 4thly. The microscopic structure of the two barks is very different.⁶ Mr. J. E. Howard, who has devoted much attention to the subject is of opinion that *Huamalties* bark is very near to, if it be not identical with, *Cinchona Chahuarguera*. Pavon (*C. Condaminea* var. β *Chahuarguera*, De Cand.), which Weddell regards as identical with his *C. Condaminea* var. α *vera*.

DESCRIPTION AND VARIETIES.—This kind of bark presents very different appearances at different ages, so as almost to defy arrangement. Some of the fine quills might readily be mistaken by inexperienced persons for *Loxa bark*. The large flat pieces, on the other hand, I have known mistaken by an experienced dealer for what he termed "flimsy" red bark.

Some of the finer quills (*Huamalties simulating Loxa Bark*) resemble those of *Loxa Bark*, but are dull gray externally, have fewer transverse cracks, are smoother, or finely striated or wrinkled longitudinally, and, when broken, appear nearly white in the interior. This is the *dull gray Huamalties* (*quinquina huamalties gris terne*) of M. Guibourt. Another kind frequently occurs in the *Loxa Bark* of commerce, and I have heard it termed *rusty crown bark*. It is in larger quills, with a whitish or grayish epidermis, which is striated or furrowed longitudinally, but is devoid of transverse cracks, and may be removed by the nail. This is the *thin and red*

¹ *Traité de Pharm.* i. 583.

² *Pharmaceutical Journal*, vol. xi. p. 129, 1851.

³ *Hooker's Companion to the Botanical Magazine*, vol. i. p. 252, 1835.

⁴ *Encyclopædie d. med.-pharm. Natural. u. Rohwaarenk.* p. 341

⁵ Mr. J. E. Howard, *Pharm. Journal*, vol. xii. p. 61, 1852

⁶ Buchner's *Repert.* 2te Reihe, Bd. xxv. S. 324

dish *Huamalties* (*quinquina huamalties mince et rougeatre*) of M. Guibourt. On some of the pieces we observe rusty-coloured warts, which, when numerous, are disposed in irregular longitudinal lines. A flat or arched variety (*verrucous white Huamalties bark*) has a whitish epidermis, with large red warts, from which the epidermis has been removed. Another kind (*verrucous rusty Huamalties*) is in quills or flat pieces, distinguished by the ochre-red or rusty colour of its outer surface, the presence of warts, arranged for the most part longitudinally, and the almost total absence of transverse cracks.

CRYPTOGAMIA.—The following cryptogamic plants are mentioned by Von Bergen as existing on this bark:—

Lichenes.—*Opegrapha enteroleuca*; *Graphis duplicata*; *Ferrucaria phæa*; *Porina papillata*; *Pyrenula discolor*; *P. mastoidea*; and *P. verrucarioides*; *Lecanora punicea*; *Parmelia melanoluca*; and *Usnea florida* & *Cinchonæ*.

COMPOSITION.—The proportion of cinchona alkaloids in this bark has been investigated by Von Santen,¹ Michaelis, Goebel and Kirst,² and Winckler.³ The following are their results:—

1 lb. of Bark.

		Cinchonia.	Quina.
Von Santen	1. Fine and middling fine quills, and flat pieces (from Cadiz in 1821)	60	0
	2. Thick warty quills, and flat pieces (from ditto)	75	0
	3. Sorts (from Lima in 1803)	60	0
	4. As No. 3 (another chest), rather heavy	48	0
	5. As No. 3 (a third chest), rather light	95	0
Michaelis	1st sort	0	12
	2d sort	48	28
	3d sort	60	34
Goebel and Kirst	(fine and thick quills of commerce)	38	28
	1. Thick quills and flat arched pieces	66	23
Winckler	2. Strong, coated, middling thick, fresh-looking quills	8	0
	3. Thin quills, which were mixed with Loxa Bark	8.5	0.6

It is tolerably obvious from the above analyses, that either different barks have been examined under the name of *Huamalties*, or that this bark is most unequal in the proportion of alkaloids which it yields. Mr. J. E. Howard⁴ says: "I have experimented on a sample of brown warty *Huamalties*, agreeing in general appearance with Goebel's Pl. x. Figs. 1—5, and found the bark rich in alkaloids, and with no peculiarity⁵ such as always marks the two varieties of *C. pubescens*."

MEDICINAL PROPERTIES.—These must vary with the proportion of alkaloids which the bark contains. Some specimens are undoubtedly of first-rate medicinal quality.

VI. CORTEX CINCHONÆ DE JAEN.—ASH CINCHONA.

Quinquina de Loxa cendré A, Guibourt; *China Jaen*; *Blasse Ten-China*, Bergen; *China Jaen seu Tena*, Goebel; *Blackish Huanuco*, Batka; *Cascarillo palido*, Ruiz.—It is uncertain at what period it was introduced into commerce. Bergen states he found it in an old collection of drugs made in 1770. It agrees with the bark described in the *Quinologia* as *cascarillo palido* (*C. ovata*, Fl. Peruv.); a specimen of which, in Ruiz's collection of barks, was examined by Bergen,⁶ and found to be identical with Ash Cinchona. It is, therefore, the produce of *C. ovata* var. *a vulgaris* of Weddell. It differs, however, completely, both in appearance and composition, from Carabaya bark, which, according to Dr. Weddell, is also obtained from this variety of *C. ovata*.

Mr. J. E. Howard⁷ admits seven sorts of bark of *C. ovata*, and refers ash bark to his first sort, or the smooth-skinned or pale variety having a light brown substance.

Ash bark is usually imported in chests, but also in serons. It is met with in a quilled form only; the quills being of middling size, or somewhat thick; being from 4 to 16 inches long, from $\frac{3}{4}$ lines to 1 inch in diameter, and from $\frac{1}{2}$ to 2 lines thick. A very remarkable character of this bark is the crookedness of the quills, which are more or less arched and twisted; from which circumstance we may infer the probability of its being obtained from a tree which grows in a damp situation. On the outer or epidermoid surface we observe a few transverse cracks, and some faint longitudinal cracks; but in these respects there is a manifest difference between this and Loxa bark. The colour of the outer surface varies between ash gray, whitish gray, and pale yellow, with blackish or brownish spots. The inner surface is either even or splintery, and of a cinnamon-brown colour. The fracture is even or splintery; the odour is tannic; the taste feebly astringent and bitter; the colour of the powder is cinnamon-brown.

Ash cinchona must not be confounded with the *ashy crown bark* to be hereafter described (p. 660).

¹ *Bergo*, Monograph. Platt. v.

² *Pharm. Waarenkunde*, i. 71.

³ *Bergo's Report*, 2te Rehe, Bd. xxv. S. 291 and 326, 1842.

⁴ *Pharmaceut. Journal*, vol. xii. p. 61, 1852.

⁵ The peculiarity here alluded to is the presence of an intensely yellow colouring matter, from which it is difficult to separate the alkaloids.

⁶ *Monogr* 349.

⁷ *Pharmaceutical Journal*, vol. xii. p. 126, 1852.

Under the name of "Cusco Bark" I have met with in commerce two barks which are probably the produce of *C. ovata* var. *a vulgaris* of Weddell, and, therefore, are allied to Ash Cinchona. One of these is a thick coarse quilled bark; the other a thin, flat, leathery sort of bark, in pieces which are four or five inches broad.

Few cryptogamic plants are found on ash cinchona. The following is a list of them, according to Bergen:¹—*Graphis sculpturata*; *Porina granulata*; *Pyrenula verrucarioides*; *Leconora punicea*; *Parmelia melanolucæ*, and *Usnea florida* & *Cinchona*.

Goebel and Kirst² obtained only 12 grains of quinine from a pound of the bark; but Winckler³ procured 28 grains from 16 ounces. Subsequently, Manzini⁴ declared that it contained neither quinine nor cinchonine, but a new alkaloid, which he called *cinchoratine* or *cinchorine*. Winckler,⁵ however, after a careful comparison, found this supposed new alkaloid to be eusconin or atame. Guibourt⁶ regards it as cinchonine. From a mean-looking specimen, Mr. J. E. Howard obtained crystallized quinidine, 0.61, and crystallized cinchonine 8.86 per cent. Some flat pieces yielded him 1.2 of quinidine and 1.6 of cinchonine.

The medicinal powers of this bark must be inferior, on account of the small proportion of alkaloid which it yields.

VII. CORTEX CINCHONÆ DE LOXA.—LOXA BARK.

SYNONYMS.—*Quinquina de Loxa*, Guibourt; *China Loxa*, Kron-China, Bergen; *Cortex China fusca*, seu *coronæ*, *s. de Loxa*, *s. peruvianus*, Goebel; *Loxa* or *Crown Bark*, Engl. commerce.

HISTORY.—*Loxa* bark, if not the first, was one of the earliest kinds of Cinchona bark introduced into Europe. It was probably the bark which Horbius,⁷ in 1693, denominated *Cascarilla della Oja*, but which Condamine more correctly termed *Corteza*, or *Cascara de Loxa*. Of late years, however, various kinds of quilled barks, differing in botanical origin, in appearance, and in chemical constitution, have been imported—sometimes mixed, sometimes unmixed—under the name of *Loxa* or *crown bark*.

BOTANY.—According to Humboldt⁸ (who speaks very positively on this point), the plant figured by M. de la Condamine is the one which Weddell terms *Cinchona Condaminea* var. *a vera*; though, as I have before stated (see *ante*, p. 634, footnote), M. Guibourt entertains some doubt about the accuracy of this statement. It is probable, therefore, that this is the source of the original or old *Loxa* bark.

C. Condaminea var. *β Candollii*, furnishes an inferior *Loxa* bark. From M. Guibourt's observation on the barks in M. Delessert's collection, it would appear that *C. Condaminea* var. *β Candollii*, yields yellow *Loxa* bark (*amarilla de Loxa*).

The bark of *C. Condaminea* var. *γ lucumæfolia*, has also been sold in London as crown bark; I shall distinguish it as *white crown bark*.

From Humboldt's observations respecting the bark of *C. scrobiculata* var. *a genuina* (see *ante*, p. 635), it would appear that this forms part of the *Loxa* bark of commerce.

Mr. J. E. Howard⁹ thinks that *C. glandulifera* is the source of the H. O. crown bark.

C. cordifolia var. *β rotundifolia*, may perhaps yield the *Ashy crown bark* of commerce.

COMMERCE.—Crown bark is imported from Loxa and Lima; in the former case it is shipped at Payta, in the latter at Callao. It is imported in serons and chests. After its arrival, it is frequently picked and sorted. The slender, finest, thinnest, and longest quills, with a short transverse fracture, form the *finest* or *picked crown bark* (*cortex cinchona coronæ electus*)¹⁰. A somewhat larger quill, with a silvery appearance of the epidermis, derived from the adherent crustaceous lichens, constitutes the *silvery crown bark*. A similar kind, but in which the external coat has a speckled appearance from the whitish lichens, with the intermediate dark-brown colour of the epidermis, constitutes the *leopard crown bark*.

VARIETIES AND DESCRIPTION.—The chief and most important barks to which the name of Crown or *Loxa* bark has been applied, are the following:—

¹ Monogr. S. 313.

² Pharmaceutische Waarenkunde, Bd. i. S. 67, 1-27-29.

³ Buchner's Repert. Bd. xxv. S. 323, 2te Reihe, 1842; also, Chemical Gazette, vol. i. p. 49, 1-12.

⁴ Journ. de Pharm. et de Chim. t. ii. p. 95, 1842; also, Chemical Gazette, vol. i. p. 45, 1842.

⁵ Buchner's Repert. Bd. xxx. S. 249, 2te Reihe, 1843; also, Chemical Gazette, vol. ii. p. 159, 1-44.

⁶ Hist. Nat. des. Drog. 4ème édit. t. iii. p. 161, 1850.

⁷ Bergen, Monogr. S. 313.

⁸ Plant. Equin. vol. i. p. 33, tab. 10.

⁹ Pharmaceutical Journal, vol. xii. p. 129.

¹⁰ Condamine observes: "They told me at Loxa, that *anciently* they preferred the *largest barks* (des plus grosses écorces), which were put aside with care as the most precious; *now*, the *smallest* are preferred. One may suppose that the dealers find their advantage in this, because the fine quills go in a smaller compass. But a director of the English South Sea Company at Panama, by which place all the bark which goes to Europe necessarily passes, assured me that the preference now shown for the *smallest quills* is founded on analyses of English chemists of both barks, and it is probable that the difficulty of drying perfectly the large quills, and their consequently becoming damaged, has contributed to bring them into discredit. The common prejudice is, that, in order to lose none of their virtue, the tree should be stripped at the waning of the moon, and on the east side of the tree; and they did not forget to make affirmation before a notary of these circumstances in 1735, as well as of its having been gathered on the mountain of Cayennum, when the last Viceroy of Peru made a provision of bark to carry to Spain on his return. The interest of the collection, which forbids them to remain inactive three-quarters of the year, has caused most of those who gather the bark to give up their prejudice, such as my host at Cayennum, who assured me that all the seasons of the year were equally proper, so long as the weather was dry."

1. **ORIGINAL OR OLD LOXA BARK.**—This is the *original* or *true crown bark*, and is probably the produce of *C. Condaminea* var. *a vera*, Weddell. It is said to have received its name from the following circumstance:—

In October, 1804, a Spanish galley, returning from Peru, was taken by our countrymen off Cadiz. Among the treasures found therein were many parcels of cinchona bark, two sorts of which were distinguished from the others by their external appearance and mode of packing. Two of these chests were marked "*Para la real familia*," i. e. "*For the royal family*," and were lined with sheet iron; they contained fine quills, of thirteen inches long, tied up by means of *bass* into bundles of about three inches in diameter. Von Bergen states he received from England, in 1824, similar bundles, under the name of *second crown*. The other sort was marked "*Para la real corte*," i. e. "*For the royal court*."¹ Occasionally, but less frequently than formerly, bundles thus packed occur in the serons of crown bark of commerce. Hayne² pointed out some differences between the Loxa bark of commerce and a bark found in Humboldt's collection, marked *Quina de Loxa*, and which had been collected from *C. Condaminea*; the peculiar characteristics of the latter are the warty prominences, the transverse cracks, which do not form rings, the browner tint of the outer surface, and a more astringent taste. In a chest of 120 lbs. of commercial Loxa bark, Goebel found only three ounces of bark corresponding to the description here given of the true Loxa bark.

I have received from Mr. Berthold Seemann a specimen of *quina fina* which he himself gathered from *C. Condaminea* var. *a vera*, Weddell, at Loxa. It is in slender quills, with numerous transverse cracks, and has a silvery appearance externally, from the presence of adherent crustaceous lichens. It is the kind which I have designated *silvery crown bark*.

Mr. J. E. Howard analyzed some "fine old Loxa" quills which were sold in 1850. They had traditionally remained in the London Docks twenty five or thirty years, and the packages were decaying with age. Some of them were tied up in bundles; some resembled *quinquina gris fibreux royal d'Espagne* of M. Guibourt; others were thick heavy quills. The first sort in bundles yielded him, in 100 parts of bark, quinine 0.714, quinidine 0.514, and cinchonine 0.04. The larger and stouter quills were richer in alkaloids, especially in cinchonine. "I conclude, therefore," says Mr. Howard,³ "that the old original 'crown bark,' the fine Loxa of Uritusinga, was one which well merited its character, on account of the quantity of alkaloids contained, which (taking the whole together, for the bark is rich in cinchonine, and Calisaya is not) equals the sum total of alkaloids in some specimens of Calisaya bark."

2. **WHITE CROWN BARK.**—By this designation I propose to distinguish the *lucuma-leaved cinchona bark*. In 1848, a chest of it was sold in London as "crown bark," yet it differs in appearance considerably from the ordinary crown bark of commerce. The small or fine quills are scarcely distinguishable from some quills of silvery crown bark given me by Mr. Seemann, who gathered them from *C. Condaminea*. The large quills, however, present an entirely different appearance from every other sort of cinchona bark with which I am acquainted. The coated large quills are devoid of transverse tracks, but are rugged externally from the longitudinal rents or fissures produced by the expansion of the growing stem; and the subacut suberous coat which is thus exposed is remarkable for its white satiny or silvery lustre. This bark is the produce of *C. Condaminea* var. *γ lucumafolia*, Weddell; and its produce in alkaloids resembles that of other varieties of *C. Condaminea*.

3. **H. O. CROWN⁴ BARK.**—This is the crown bark usually found in commerce. It is imported from Payta, and occurs in the form of single and double, fine and middling, coated quills, which vary in length from 6 to 15 inches; in diameter, from 2 lines to an inch; in thickness, from one-third of a line to 2 lines.

a. Some of the quills are remarkably devoid of lichens; are composed of a thin bark, which externally has a brown shrivelled appearance, being covered with numerous longitudinal wrinkles, and having very few transverse cracks. The transverse fracture is short. The internal surface is of a cinnamon colour, but the fractured surface is pale yellow.

β. Other quills approximate in appearance to those of gray bark. They are larger and coarser than the preceding, are more or less grayish externally from adherent lichens, and are furnished with numerous transverse cracks, some of which extend completely around the quill in the form of a ring.

γ. Some of the quills greatly resemble those of ashy crown bark, consisting of twisted quills, which have the same patchy (black and white) appearance, from the adherent lichens.

The origin of "H. O. crown" bark is not accurately known. Mr. Howard and myself found no bark exactly resembling it in Pavon's collection. As Humboldt states that the bark of *C. scrobiculata* is sold as "quina fina," it might be presumed that this is in part the source of the "H. O. crown" bark, which appears to have replaced, in commerce, the original old Loxa bark (*C. Condaminea*). But Mr. J. E. Howard has assigned several reasons for believing that ashy

¹ Bergen, Monograph, S. 310.

² Pharmaceutical Journal, vol. xi. p. 494.

³ Goebel and Kunze, Pharm. Waarenk. i. 36.

⁴ "The 'H. O.' and a crown were brands adopted, in the time of the Spanish dominion, for two different sorts of bark, which are both now included under the general title, 'crown bark.'"—(J. E. Howard, Pharm. Journ. vol. xi. p. 494.)

crown bark is identical with the *cascarilla negrilla* of Poeppig, and, therefore, is produced by *Cinchona glandulifera*.

Mr. J. E. Howard has analyzed two samples of this bark, and the following are his results:—

1000 parts.	Quinidine (finely crystallized from ether).	Cinchonine.
Fine sample (in the market in 1850)	5.7	0.6
A beautiful sample (in the market in 1851)	10.5	0.8

The sample last mentioned "was in larger quills, and the large quills must always be expected to contain more alkaloid than those which consist almost entirely of outer coat. So that we have not only the substitution of barks poorer in alkaloids for the old Loxa richer in alkaloids, but we have quinidine substituted for quinine, if this be of any importance."

4. **ASHY CROWN BARK** of English commerce; *China Pseudo-Loxa* or *Dunkele-Ten-China*, Bergen; *Dunkle Jaen China*, Goebel; *Quinquina de Loxa cendré B*, Guibourt—"This bark must not be confounded with the ash or pale Jaen bark (p. 657), from which it is quite distinct.¹ It is imported from Lima in serons and bags. It occurs in quills of about the size of the fingers, and which abound in foliaceous and filiform lichens, (*Parmelia melanoleuca*, *Sticta aurata*, *Usnea*, &c.) The powdery and crustaceous lichens give this bark a very speckled or patchy appearance; the white, gray, and black patches being predominant. Some of the black patches are soot-like. Many of the quills are covered with rusty warts or fungoid tubercles, which perhaps have been produced by the puncture of an insect. Quills covered with these warts (which are sometimes as large as a coffee-seed) have a scabious appearance. The epidermis is marked by longitudinal wrinkles and transverse cracks, by which, as well as by its blacker colour, it is readily distinguished from ash bark. The internal surface is of an orange or cinnamon colour. The taste of this bark is bitter. This bark agrees with the specimen in Pavon's collection marked "*Cascarilla con hojas redondas de Quebro de Loxa*," (i. e. "the bark of the round-leaved cinchona of the Quebro de Loxa.") From this it would appear to be the produce of *C. cordifolia* var. *β rotundifolia* of Weddell. Bergen says that it agrees with a bark contained in Ruiz's collection, which was said to be obtained from *C. lancifolia* of Mutis. But it differs from the lancifolia barks with which I am acquainted.

This bark has been analyzed by Mr. J. E. Howard; and the following are his results:—

1000 Parts of	Quinidine and Quinine.	Cinchonine.	Total Alkaloids
Ashy crown, from Lima	5.00	9.14	14.14
Ashy crown mixed with corky crown, from Lima	4.00 (quinidine chiefly)	2.55	6.55
Ashy crown (corresponding with the Dunkele-Ten-China), from Lima	4.57	3.00	7.57

5. **WIRY LOXA BARK**; *Twiggy Loxa Bark*.—Imported from Payta in serons. In April, 1852, I saw three serons of this bark put up for sale. It occurs in very slender, wire-like quills, which are tolerably smooth externally, with scarcely any transverse cracks. The epidermis is brown, in some places slightly gray, without any adherent foliaceous or filiform lichens. Many of the quills are lined by a thin shaving of pale yellow wood with the bark from the branch. Its taste is very astringent, and but slightly bitter. To the fracture it is short and resinous. It yields scarcely any alkaloid, and its quality, therefore, is very inferior. Nothing certain is known of its origin.²

CRYPTOGAMIA.—The following is Fée's list of the Cryptogamia found on Loxa bark:—

Lichenes.—*Opegrapha globosa*; *O. Condaminea*; *Graphis fulgurata*; *Arthonia suensisgraphia*. *A. marginata*; *Glyphis favulosa* (rare); *Chiodecton effusum*; *Pyrenula verrucarioides*; *Aspidium Cinchonarum*; *Lepora flava*; *Lecidea peruviana*; *Lecanora russula*; *L. subfusca*; id. var. *β pulverulenta*; *Parmelia crenulata*; *P. glandulifera*; *Sticta aurata*; *Collema azureum*; and *C. diphanum*.

COMPOSITION.—Loxa bark (quinquina gris) was analyzed by Pelletier and Caventon,³ and by Bucholz.⁴

¹ M. Guibourt (*Hist. Nat. des. Drog. simpl.* 4me éd. tom. iii. p. 152, 1852, has included both ash or pale Jaen bark and ashy crown bark under one name; viz. that of *quinquina de Loxa cendré* ashy Loxa bark. The former constitutes his variety "A," the latter, his variety "B."

² On account of its remarkably slender quills, this bark might be presumed to be the *cascarilla delgada* or *delgadilla* (slender bark), or *cascarilla fina delgada* (fine slender bark), which Ruiz and Pavon state to be obtained from *Cinchona hirsuta*; but it is devoid of the small transversal cracks which it is said, render the surface of the *delgada* bark rough. In its smoothness and colour, wiry Loxa bark somewhat resembles young *negrilla* bark.

³ *Journ. de Pharm.* vii. 70.

⁴ Gmelin, *Handb. d. Chem.* ii. 1253.

Pelletier and Caventou's Analysis.

Kinate of cinchonia.
Kinate of lime.
Green fatty matter.
Red cinchonic.
Soluble red colouring matter (tannin).
Yellow colouring matter.
Gum.
Starch.
Lignum.

Gray cinchona.

Bucholz's Analysis.

Cinchonia	0.36
Kinic acid	1.17
Kinate of lime	1.30
Hard resin (red cinchonic)	9.97
Bitter soft resin	1.56
Fatty matter, with chlorophylle	0.78
Tannin, with some chloride of calcium (?)	5.80
Gum	4.43
Starch	a little
Lignin	74.43

Commercial Loxa bark 99.80

Soulbeiran¹ states, that one lb. of Loxa bark yields from one and a half to two drachms of sulphate of cinchonia. It is somewhat remarkable that Von Santen² obtained quina, and but little cinchonia, from Loxa bark, as the following table shows:—

1 lb. of Loxa Bark.	Sulphate of Quina.	Pure Cinchonia.
	grains.	grains.
Fine selected quills	5	—
Moderately thick quills and pieces	12	4 $\frac{3}{4}$
Fine and middling quills	2	2 $\frac{3}{8}$
Moderately thick pieces	21 $\frac{1}{4}$	—
Selected thick, heavy pieces, with grater-like bark	53 $\frac{1}{4}$	—

Winckler³ procured from 16 ounces of selected Loxa bark 56 grains of alkaloids; namely, 33 grains of pure quinine and 23 grains of cinchonine.

Mr. Howard's analyses before quoted have shown that the different barks, known in commerce as Loxa or Crown bark, vary considerably in the proportion of alkaloids which they contain.

MEDICINAL PROPERTIES.—Fine old Loxa bark is probably almost equal in therapeutical powers to Calisaya bark; and the same may be said of the lucuma-leaved cinchona bark. The ordinary Loxa barks of commerce are, however, very inferior in medicinal activity.

VIII. CORTEX CINCHONÆ RUBRÆ.—RED CINCHONA.

Cinchona rubra, L. E. D.

SYNONYMES.—Quinquina rouge verruqueux, and non-verruqueux, Guibourt; *China rubra* Rothe *China*, Bergen; *China rubra*, *Cortex Chinæ ruber*, Goebel; *Cascarilla roxa verdadera*, Laub. [genuine red cinchona.]

HISTORY.—The earliest travellers in South America, who have noticed cinchona bark, distinguish the different sorts by their colour; and both Mr. Arrot and Mons. Condamine speak of a red bark (*cascarilla colorada*), and describe it as being of superior quality. Dr. Saunders⁴ states that, in the year 1702, a parcel of bark (which he says was the red kind) was taken on board a Spanish vessel, and a portion of it fell into the hands of a celebrated London apothecary, Mr. D. Pearson. In 1779, another Spanish ship, bound from Lima to Cadiz, was taken by an English frigate, and carried into Lisbon. Her cargo consisted principally of red bark, and was, for the most part, sent to Ostend, where it was purchased at a very low price by some London druggists, who, after some difficulty, contrived to get it introduced into practice.

BOTANY.—Although the term *red bark* is now usually employed to designate a particular sort of bark, yet a red colour is in reality not characteristic of any one bark in particular, but is common to many; and, moreover, it appears to be a non essential quality, and to depend on accidental circumstances, such as locality, soil, age of the tree, mode of drying the bark, &c. Thus *C. lancifolia* yields both a red as well as an orange bark; and some of the pieces of the red bark of commerce are scarcely distinguishable in colour from those of yellow bark. Weddell says he has met with the red tint in the barks of *C. ovata*, *C. scrobiculata*, *C. pubescens*, and even in *C. Calisaya*; and at one time he fancied that the first-mentioned of these species (*C. ovata*) was the source of the genuine red bark of commerce.

The *Cascarilla magnifolia* var. *a. vulgaris* of Weddell (*Cinchona oblongifolia* of Mutis) yields a purple-red bark called *Quina roxa*, or *Quina Azahar o roja de Santa Fé*; and which was supposed to be the red bark of commerce. But Bergen has examined the bark bearing this name in the collection of Ruiz, and finds that it is not commercial red bark but the *Quinquina nova* of the French pharmacologists. Moreover, Schrader (who received a piece of the bark from Humboldt) declared it to be a new kind; and Guibourt⁵ states that the red bark of Mutis, which was deposited by Humboldt in the Museum of Natural History of Paris, is not com-

¹ *Traité de Pharm.* i. 603.² Bergen, *Monogr. Tab. zur 5ten Platte.*³ *Bucquer's Repertorium*, 2te Reihe, Bd. i. S. 213, 1835; and Bd. xxv. S. 325, 1842.⁴ *Observations on the Superior Efficacy of the Red Peruvian Bark*, p. vi. 1782.⁵ *Hist. des Drog.* 4me édit. t. iii. p. 123, 1850.

mercial red bark, but *Quinquina nova*. To these statements may be added the testimony of Ruiz and Pavon, and of Humboldt; the first two of which writers state that the *Quina rosa* is obtained from *Cinchona oblongifolia*,¹ but they do not know the origin of *Quina colorada* (the red bark of commerce); and Schrader states that Humboldt declared he did not know the tree that yielded red bark.²

COMMERCE.—Imported from Guayaquil and Lima in chests. Good samples are scarce. I am informed by an experienced dealer that this bark was formerly imported in much larger sized pieces than are now met with.

DESCRIPTION.—Red bark occurs in quills and flat pieces. The quills vary in diameter from two lines to an inch and a quarter; in thickness, from one-third to two lines; in length, from two to twelve or more inches. The so-called flat pieces are frequently slightly curled; their breadth is from one to five inches; their thickness from one-third to three quarters of an inch; their length from two inches to two feet.

Red bark is generally coated, and consists of liber, the cellular and suberous coats, and usually more or less of the epidermis; its outer surface is usually rough, wrinkled, furrowed and frequently warty. The colour of the epidermis varies; in the thinner quills it is grayish-brown, or faint red-brown; in thick quills and flat pieces it varies from a reddish-brown to a chestnut-brown, frequently with a purplish tinge. As a general rule, it may be said that the larger and coarser the quills and pieces, the deeper the colour. Cryptogamic plants are not so frequent on this as on some other kinds of bark. The cellular coat is frequently thick and spongy, especially in large flat pieces; much more so than in yellow bark. It forms the round tubercles or warts. The inner surface of the bark is, in fine quills, finely fibrous; in large quills and flat pieces, coarsely fibrous or even splintery. Its colour increases with the thickness and size of the pieces; thus, in fine quills, it is light rusty brown; in thick quills and flat pieces it is a deep reddish or purplish brown. Some of the specimens of red bark which I have received from Von Bergen, as well as of those which I have found in English commerce, approach yellow bark in their colour. The transverse fracture of fine quills is smooth; of middling quills, somewhat fibrous; of thick quills and flat pieces, fibrous and splintery. The taste is strongly bitter, somewhat aromatic, but not so intense and persistent as that of yellow bark; the odour is feeble and tan-like; the colour of the powder is faint reddish-brown.

VARIETIES.—The obvious and common distinction is into *quilled red bark* and *flat red bark*. The warty pieces constitute the *quinquina verruqueux* of Guibourt; the pieces without warts are the *quinquina non-verruqueux* of the same pharmacologist. In the red bark of commerce, we frequently find pieces with a white micaceous suberous coat; these, which are probably the produce of a distinct species of *Cinchona*, constitute the *quinquina rouge de Carthagene* of Guibourt.³

The consumption of red cinchona being very very small, but little attention has been paid to it, and no distinctions are made of it, except into the *quilled* and the *flat*; the latter being subdivided into *coated* and *uncoated*.

COMPOSITION.—According to Pelletier and Caventou,⁴ red bark contains *superkinate of cinchonia*, *superkinate of quina*, *kinate of lime*, *red cinchonin*, *soluble red colouring matter* (tannin), *fatty matter*, *yellow colouring matter*, *lignin*, and *starch*. Soubeiran⁵ states that one lb. of deep red cinchona yields two drachms of sulphate of quina and one drachm of sulphate of cinchonia; while one lb. of pale red cinchona yields a drachm and a half of the sulphate of quina and one drachm of sulphate of cinchonia.

The following are the quantities of cinchona alkaloids obtained from this bark by Von Santen,⁶ by Michaelis, by Goebel and Kunze,⁷ and by Winckler.⁸

¹ The *Cinchona oblongifolia*, Mutis (*C. magnifolia*, Fl. Peruv.), is the *Cascarilla magnifolia* var. *z* *rulgaris*, Weddell. It is, therefore, a false cinchona, and its bark might be distinguished as *false red bark*. It is the *Savanilla bark* of Batka (*Pharmaceutical Journal*, vol. xi. p. 321, 1852).

² Bergen, *Monogr.* S. 268.

³ *Hist. Nat. des Drog.* 4eme edit. t. i. p. 126.—In the 3d edit. of Guibourt's work, this bark is called *quinquina rouge à épiderme blanc et micacé*, and in the 2d edit. *quinquina Carthagène rouge*. The author thinks that it differs from *spongy Colombia bark* (*quinquina de Colombie spongieux*) only in colour. He says that "the evident resemblance which exists between the *genuine red non-verrucous bark* and the *red Lima bark*, between the *red woody Carthagena bark* and *woody Colombia bark*, and lastly, between *red and spongy Carthagena bark* and *spongy Colombia bark*, has for some time past led me to think, what I have not hitherto stated verbally, that these red cinchonas do not constitute distinct species, but are only particular states of other species, caused probably by the great age of the trees."

⁴ *Journ. de Pharm.* vii. 92.

⁵ Bergen, *Monogr.* Plate I.

⁶ Buchner's *Repert.* 2te Reihe, Bd. xxv. S. 325, 1812.

⁷ *Traité de Pharm.* i. 663.

⁸ *Pharm. Waarsk.* i. 72.

1 lb. of Bark.		Cinchona.	Sulphate Quina.	Quina.
		grs.	grs.	grs.
Von Santen	1. Fine quills of fresh appearance (from Cadiz in 1803) . . .	70	77	
	2. Large, broad, flat pieces, of fresh brownish-red appearance (same chest) . . .	90	15	
	3. Middling quills, from their pale appearance probably twenty years older than the previous (from Cadiz in 1819) . . .	97	31	
	4. Broad flat pieces, not so thick as No. 2 (same chest as No. 3) . . .	80	30	
	5. Middling quills, heavy, old (from London to Hamburg in 1815; not met with now) . . .	150	11	
	6. Thicker, heavier quills (same chest) . . .	184	9	
	7. Thick flat pieces, quills, and fragments (above 80 years in Hamburg; a pale kind) . . .	20	7	
Michaelis	8. Thin flat pieces (same chest) . . .	32	—	64
Goebel and Kunze	9. Flat pieces (same chest) . . .	65	—	40
Winckler	1. Dark heavy flat-coated pieces . . .	180	—	8
	2. Pale thin flat pieces . . .	80	—	6

CRYPTOGAMIA.—The following are the cryptogamic plants on red cinchona, according to Fée:—

Lichenes.—*Opegrapha Bonplandi*; *O. farinacea*; *Graphis Acharii*; *G. exilis*; *G. frumentaria*; *Pyrenula verrucaroides*; *Verrucaria sinapisperma*; *Thelotrema urceolare*; *T. terebratum*; *T. myriocarpum*; and *Lecidea conspersa*.

MEDICINAL PROPERTIES.—Red bark, when of good quality, approximates in its therapeutical powers to the best Calisaya bark.

IX. CORTEX CINCHONÆ CONDAMINEÆ PITAYENSIS.—PITAYA CONDAMINEA BARK.

Quinquina Pitaya, ou de la Colombie, ou de Antioquia; Guibourt, Hist. des Drog. t. iii. p. 140. 4me éd. 1850; *Quinquina Pitaya*, Peretti, Journ. de Pharm. t. xxi. p. 513, 1835?; Muratori, Pharm. Central-Blatt für 1839, p. 662? According to the observations of Mr. J. E. Howard and myself, made on M. Guibourt's specimens, the *quinquina brun de Carthagène* of the last-mentioned author is identical with the *Pitaya Condaminea bark*.

The bark of *Cinchona Condaminea* var. *pitayensis*, Weddell,³ Imported into England from Buenaventura in New Granada.

Bark consisting of single or double quills, or half-rolled pieces. I have specimens which are more than a foot in length. Some samples, however, which I have received, consist of pieces not exceeding two or three inches in length, sometimes entirely, at others only partially, coated; the partially coated pieces consist of the suberous and cellular coats and liber. Epidermis, when present, dark brown, frequently coated by crustaceous lichens, marked by numerous closely set, transverse cracks, with prominent or slightly everted borders, which give the bark a grater-like feel; and here and there presenting round or oval warts or fungoid rusty tubercles, varying in size from a grain of wheat to a seed of coffee, and usually marked like the latter with a longitudinal, sometimes also with a transverse, fissure. The suberous coat in some pieces much developed, spongy or fungous, fawn yellow, sometimes brown in the interior and fawn-yellow externally and internally. Resinous tissue, on the inside of the suberous coat from which it is definitely separated, shining, of a dark-reddish colour. Liber gradually passing into the resinous coat, hard, dense, dark reddish-brown; cortical fibres fine and short.

Pitaya-Condaminea is a firm heavy bark, having a very bitter, rather disagreeable flavour, which is slowly developed.

This bark is rich in alkaloids, and serves for the manufacture of disulphate of quinine. It contains cinchonine, quinidine, and quinine. From one kilogramme (or 1000 grammes) of this bark, M. Guibourt obtained 23 grammes of crystallized cinchonine, and 11 grammes 52 centigrammes of sulphate of quinine; showing that it is one of the richest cinchona barks. Muratori has published an analysis of "Pitaya bark," but I am doubtful whether his bark is

¹ Cours d'Hist. Nat. ii. 265.

² The designation "*Pitaya* or *Pitaya bark*" having been loosely applied to several different sorts of bark, it is somewhat difficult to determine with certainty the synonyms of the bark described in the text. From M. Guibourt I received samples of it in 1830. Mr. J. E. Howard informs me that the bark which M. Guibourt recently showed him as *lignous Pitaya bark*, and as the bark which Peretti analyzed, is a *lanceifolia* bark. It is, therefore, probable that Peretti's *pitayne* is identical with *quinidine*.—The *Pitaya-Condaminea* bark above described must not be confounded with the *bicoloured bark* (*quinquina bicolore* of M. Guibourt), which has also been called "*Pitaya bark*."

³ *Histoire Naturelle des Quinquinas*, 1849.—More recently (*Ann. des Sciences Naturelles*, May, 1849) Weddell has made this plant a distinct species under the name of (*C. Pitayensis*; but, to avoid the confusion of names, I have preferred the designation of "*Pitaya-Condaminea bark*" to that of "*Pitaya bark*."

identical with that which I have described. From 12 ounces of bark he obtained 17 grains of quinine, 80 grains of cinchonine, and 18 grains of a peculiar alkaloid [quinidine?].

If the observations of Mr. Howard and myself, as to the identity of Guibourt's *brown Carthagena bark* and the *Pitaya Condaminea bark*, be correct, it follows that this is the bark which Pelletier and Caventon¹ analyzed under the name of *quinquina Carthagène*, and which they found to contain both quinine and cinchonine, and to be perfectly analogous in composition to red bark. The resinoid matter in it was very abundant.

Chemical analysis proves that, in a medicinal point of view, the *Pitaya-Condaminea bark* is one of the most valuable cinchona barks. In New Granada it is in great repute;² and experiments made with it in Italy³ show that its reputation is well deserved.

X. CORTEX CINCHONÆ LANCIFOLIÆ.—LANCE-LEAVED CINCHONA BARK.

SYNONYMES.—*Quina naranjada* vel *Q. primitiva*, Mutis; *Quinquina orange*, Humb.; *Cascarilla naranjada de Santa Fé*, Lambert; *Quinquina Carthagène spongieux*, Guibourt, 1826; *Q. orange de Mutis*, Guibourt, 1850; *Quinquina rouge de Carthagène*, Guibourt; *China flava fibrosa*, Gœbel,⁴ 1827—29; *New Spurious Yellow Bark*, Pereira, 1830; *Cinchona aurantiacea de Santa Fé*, Pereira, 1842; *Orange-coloured Cinchona Bark*: *Coquette* [*Caqueta*?] *Bark*, English commerce; *Bogota Bark*, *Chinarinde von Bogota (China Bogotensis)*, Mettenheimer,⁵ 1852.

In English commerce, the name of *Carthagena bark* is applied to this, as well as to the bark of *C. cordifolia*, even when it is shipped from a port on the Pacific. By way of distinction, the former may be called *spongy* or *fibrous Carthagena bark*, and the latter *hard Carthagena bark*.

HISTORY.—This bark was distinctly noticed in 1793 by Mutis⁶ who claims to be the discoverer of the tree yielding it; but the claim is contested by Lopez Ruiz, who asserts that he discovered it at Santa Fé in 1772.⁷ By Mutis and his followers the febrifuge qualities of this bark have been greatly lauded; by others, much depreciated. "The effect of mercantile cunning," says M. Humboldt, "went so far, that, at the royal command, a quantity of the best orange-coloured cinchona bark, from New Granada, which M. Mutis had caused to be peeled at the expense of the king, was burned, as a decidedly inefficacious remedy, at a time when all the Spanish field-hospitals were in the greatest want of this valuable product of South America."⁸ In 1830, I met with it in English commerce under the name of *New Spurious Yellow Bark*. It was unsalable, and lying in a warehouse at the London Docks. I sent a specimen of it to M. Guibourt, who identified it as the bark which he had described as *spongy Carthagena bark* (*Quinquina Carthagène spongieux*), and which M. Humboldt had deposited in the *Muséum d'Histoire Naturelle* of Paris, as Mutis's *Quina naranjada*.

Within the last few years it has been again introduced into commerce by M. Lopez, of Bogota, as a source of quinine, under the name of *Coquette*⁹ (or *Caqueta*?) *bark*; and the high price of Calisaya bark has induced manufacturers to employ *Coquette bark* in the manufacture of disulphate of quinine; and in this way it has obtained, as is observed by Mr. J. E. Howard,¹⁰ "a certain reputation in commerce, and proves neither so good as was boasted on the one hand, nor so bad as was represented on the other, in the celebrated controversy between the botanists of Peru and of New Granada."

BOTANY.—This bark is the produce of *C. lancifolia* of Mutis (the *C. condaminea* var. *δ lancifolia* of Weddell.)

COMMERCE.—The *lancifolia* bark is chiefly brought to England from New Granada, usually by way of Bogota and Carthagena on the Atlantic side. Occasionally, a similar species of bark is brought from Lima in Peru.

DESCRIPTION.—The *lancifolia* barks of commerce vary considerably in appearance. Those

¹ *Journ. de Pharm.* t. vii. p. 101, 1821.

² In the *Times* newspaper for September 29, 1824, it is stated that a mule's load of "Pitaya bark" had been sent to the British Consul at Bogota, for transmission to England; the Colombians considering it to be equal, if not superior, to Peruvian bark. But as no description of the bark is given, it is impossible to determine what sort of bark is here referred to. More recently, the government of Colombia sent to Rome, as a present to Pope Gregory XVI., some "Pitaya bark," which fetched a high price, and was said to be preferred in Colombia to other species of cinchona barks for the treatment of fevers. *Journ. de Pharm.* t. xxi. p. 513, 1835). A specimen of this bark was sent to Paris, and was declared by Guibourt (*Bullet. de l'Académie Royale de Médecine*, t. iv. p. 245, 1839—40) to be identical with his *Colombia* or *Antioquia* bark. The medicinal efficacy of Muratori's Pitaya bark has been proved by Dr. Vallenzesca, of Valencia.

³ Vallenzesca, quoted by Muratori.

⁴ *Jahrbuch für prakt. Pharmacie*, Bd. xxiv. p. 229, April 1852.

⁵ *Papel Periodico de Santa Fé*, Num. iii. Oct. 11, 1793. p. 465; also, *Mercurio Peruano de Historia, Literatura, y Noticias Publicas* que da a luz la Sociedad Académica de Amantes de Lima, tomo xii. 1.º 211. Lima, 1795.

⁶ Lambert's *Illustr.* pp. 28 and 83; also, Lopez Ruiz, *Defensa y Demostracion del verdadero descubridor de las Quina del Reyno de Santa Fé*, en Madrid, 1802.

⁷ Humboldt, in Lambert's *Illustr.* p. 33.

⁸ The commercial name for it is *Coquette* or *Coqueta*. It is probable, I think, that the word should be *Caqueta*, one of the names of the Yapura or Japura River, which rises in the Andes of New Granada.

¹⁰ *Pharmaceutical Journal*, vol. xi. p. 562, 1852.

obtained from the younger stems and branches would scarcely be identified, by a superficial observer, with those procured from older stems. But their leading and common characteristic is an extremely fibrous quality.¹ They may be arranged in two divisions:—

1. Barks of young stems and of branches, mostly quilled, coated usually with a brownish or yellowish epidermis, often covered with whitish crustaceous lichens, which give it a grayish or silvery appearance, as well as with foliaceous and fibrous lichens. The quills vary in size, from that of the little finger to an inch and a half in diameter. Some of them are smoothish, others rather rough from numerous short slight cracks (longitudinal and transverse), with slightly everted edges. They are extremely fibrous, and moderately bitter. Altogether, they would pass with many observers for *gray barks*.² It is the very fibrous character of this bark that must have given origin to the name of *towy bark* (*C. stupea*; *Quina estoposa*). Mr. J. E. Howard considers this bark to be identical with Guibourt's *King of Spain's fibrous red Loxa cinchona* (quinquina de Loxa rouge fibreux du Roi d'Espagne), and with Lambert's *lizard-coloured* (lagartijada) bark, which is described as being entirely ligneous.

According to Mr. J. E. Howard, the bark which was analyzed by Peretti,³ under the name of *Pitaya bark*, was a coated lancifolia bark in coarse quills. His opinion is founded on the examination of specimens shown to him by M. Guibourt,⁴ who has described it as being identical with *Pitaya-Condaminea* bark (see p. 663.)

Uncoated lancifolia quills are sometimes met with. In form and size they resemble coarse *casia lignea*.

2. Barks of the trunk or of old stems composed of the liber, the cellular coat, and usually a whitish or yellowish-white thin micaceous suberous coat. The larger pieces are semi-cylindrical, or more or less channelled, 4 or 5 inches in diameter, $\frac{1}{2}$ of an inch thick, and vary in length from 1 or 2 to 21 inches. The liber is extremely fibrous, very slightly bitter, in some pieces almost insipid, and of an orange or red colour. The fracture of the cellular coat is short, of the liber long-fibrous or stringy. Many of the pieces are marked by one or more oblique grooves or depressions apparently produced by a twining plant, and which are almost peculiar to this bark.

In general, this bark, as found in commerce, is *trimmed*; that is, part of the outer coat has been removed by rasping.⁵ These trimmed pieces are somewhat smooth externally, covered with bark dust, as if abraded from mutual friction, and present here and there flat and angular marks, the result of the trimming process, and resembling those seen on trimmed Russian rhubarb.

In regard to colour, there are two sorts of lancifolia bark, one orange or yellow, the other red. *Orange lancifolia bark* is the standard sort, and to which the name of *Coquetta bark* is exclusively applied. It is Guibourt's *quinquina orange de Mutis*. The *red lancifolia bark* is known in commerce as *red Carthage bark*. It is Guibourt's *quinquina rouge de Carthage*. It is a New Granada bark, gathered from a tree growing side by side with that which yields the orange lancifolia bark, and is employed by chemical manufacturers in the preparation of quinine. The trees which respectively yield these two barks are probably varieties of the same species. A red lancifolia bark is imported from Peru, and is of better quality, for, though not rich in alkaloid, it yields quinine.

Composition.—This bark yields quinine, quinidine, and cinchonine, but in very variable proportions. In some sorts (e. g. the red Carthage bark) the quinidine greatly predominates; and hence they are sometimes called “quinidine barks.”

Mr. J. E. Howard suspects that Peretti's *pitayne* is identical with quinidine.

The following are the results of some experiments on *Coquetta bark*:—

Expt. 1—7000 grains of bark yielded 158 grains of alkaloid, soluble in pure washed ether, and 44 grains of alkaloid, insoluble in ether but soluble in alcohol. The 158 grains of alkaloid, when converted into disulphate of quinine, yield 112 grains of the crystallized salt.

Expt. 2—7000 grains of bark furnished 158 grains of alkaloid, which yielded 126 grains of crystallized disulphate of quinine.

Expt. 3—7000 grains of bark gave 56 grains of alkaloid, which, converted into disulphate of quinine, yielded 36 grains of the crystallized salt.

Mr. Hindley has kindly furnished me with his results obtained by operating on 1 lb. avoird. (7000 grains) of bark; they are embodied with the preceding in the following table:—

¹ The bark contained in Pavon's collection in the British Museum, and marked “*Quina estoposa de Loxa*,” (Towy [or Fibrous] Cinchona of Loxa,) is probably a lancifolia bark (see Mr. J. E. Howard's paper in the *Pharmaceutical Journal*, vol. xi. p. 558, 1852).

² In April, 1852, some serons of a quilled lancifolia bark were exposed for sale at the London Docks, along with serons of gray barks, from which they did not appear to be distinguished.

³ *Journal de Pharmacie*, t. xxi. p. 513, 1835.

⁴ *Bulletin de l'Académie Royale de Médecine*, t. iv. p. 245, 1839; and *Hist. Nat. des Drog.* 4me édit. t. iii. p. 111, 1850.

⁵ Ruiz, in his *Quinologia* (Germ. trans. p. 36), expresses his opinion that the stems and thick branches of cinchona trees should be rasped, before peeling them, in order to get rid of the epiderm.

7000 grs. of Bark.		Disulphate of Quinine.	Quinidine.	Cinchonins.
Expt. 1.	Coquette bark	112	Undetermined. . . .	Undetermined.
" 2.	"	126	"	"
" 3.	"	36	"	"
Mr. Hindsley	{ Coquette bark	72.1	10.5	39.8
	{ Lancifolia trimmed	32.2	17.5	24.5
	{ Uncoated quill lancifolia	57.4	16.1	68.2

MEDICINAL PROPERTIES.—Chemical analysis shows that this bark varies considerably in its strength; but in general it may be regarded as a moderately good bark.

XI. CORTEX CINCHONÆ DURÆ DE CARTHAGENA.—CARTHAGENA HARD CINCHONA BARK.

SYNONYMES.—*Quinquina de Carthagène jaune pale*, Guibourt; *China flava dura*: *Harte yelle China*, Bergen; *Quina amarilla* [*Bogotensium*], Mutis; *Quina jaune*, Humboldt; *Cascarilla-Mula* vel *Mula-Cascarilla*, Peruv. and Boliv.; *Yellow Bark of Santa Fé*; *Carthagena bark*.

HISTORY.—This bark was first noticed by Mutis,¹ under the name of *quina amarilla*, or yellow bark of Bogota.

In English commerce, the name of Carthagena bark is applied generally to the barks of *C. cordifolia* and *C. lancifolia*.

BOTANY.—Hard Carthagena bark is the produce of *C. cordifolia* var. *a. vera*, Weddell. This is proved by the evidence of both Guibourt and Bergen, the former of whom examined Humboldt's authentic specimens of Mutis's yellow bark; and the latter, the specimens in Ruiz's collection.

COMMERCE.—This bark is imported chiefly from New Granada, but sometimes from Peru and Bolivia. It usually comes over in drum-like serons of about 80 lbs. net, or in half-chests of about 70 lbs.

DESCRIPTION.—It occurs in fine, middling, and thick quills, and in flat pieces. The quills vary in diameter from three to eight lines, in thickness from half to one and a half lines, in length from five to nine, rarely to fifteen inches. The flat pieces are more or less twisted, arched, or warped (sometimes like pieces of dried horn) in drying, and are from a half to two inches broad, two to seven lines thick, and four to eight, rarely to twelve inches, long. Both quilled and flat pieces are met with either coated or uncoated. The coated pieces often bear considerable resemblance to Cusparia bark. Weddell compares the appearance of the derm of the quilled pieces to that of the bark of the same age of *C. pubescens*. The periderm or coat, which is usually more or less rubbed off, is thin, soft, somewhat corky, laminated, with irregular longitudinal furrows; transverse cracks are very rare. The epidermis is whitish, yellowish-white, or ash-gray. In the flat pieces, the periderm is sometimes rendered tuberculous by the development of small cellular masses between the periderm and the cellular coat. The uncoated pieces consist of the liber and cellular coat. On their external surface we frequently observe irregular, flexuous, longitudinal, but not very deep furrows. Here and there we perceive whitish or grayish spots arising from the persistence of shreds or fragments of the periderm. The internal surface varies from smoothish to fibrous; often the fibres project obliquely, giving the bark a scaly-fibrous appearance. The prevailing tint of the cortical layers is usually dull ochre-yellow. Externally, the uncoated pieces are reddish or brownish-yellow. Internally, the tint is brighter and more or less orange-coloured in the younger and fresh pieces; in older pieces it is more brownish. The transverse fracture short, externally suberosus, internally more or less fibrous. The longitudinal fracture (which is with difficulty effected) is uneven, short, and in some pieces coarse-splintery. The taste is moderately bitter and astringent. The powder is cinnamon-coloured.

Some of the coarse uncoated quills are very smooth to the touch, and might well bear the name of *velvet bark*, which Humboldt says is applied to this bark by the common people in New Granada.

I have received from Sir William Hooker two sorts of hard Carthagena bark, differing but slightly from each other, accompanied with a note signed by Jose Manuel Restrepo, and dated Bogota, 13th of December, 1850. They are described as being the produce of two varieties of *C. cordifolia*:—

"*C. cordifolia*, No. 1.—The fruit of this species is long, yellow, and abundant. It is found in the forests under a higher temperature than *C. lancifolia*, and is more luxuriant and thicker than the latter.

"*C. cordifolia*, No. 2.—The fruit is smaller than that of No. 1, and is black. The fibres of the leaves have but little red, and rather incline to green. Is this the *C. ovata* of Weddell?

"In some forests these two kinds of bark produce no sulphate of quinine. To what can this be owing? Probably to the nature of the soil or the age of the tree?"

CRYPTOGAMIA—Very few cryptogamia are found on this bark. The following are those mentioned by Bergen:—

¹ *Papel Periodico de Santa Fé de Bogota* [edited by Rodrigo Socorro]. No. 59—125, 1793—1794.

Lichenes.—*Trypethelium variolosum*; *Thelotrema bahianum*; *Pyrenula poronoides*; *P. discolor*; *Parmelia melanoleuca*; *Usnea florida* & *Cinchona*.

COMPOSITION.—This bark yields quinidine and cinchonine. Weddell says that in France it has been found to yield a very small proportion only of cinchonine, and scarcely any quinine. But the reports of the German chemists are very different.

The following are the quantities of the cinchona alkaloids which Von Santen and Goebel and Kirst obtained:—

	1 lb. of Bark.	Cinchonia.	Sulphate of Quina.
Von Santen	{ 1. Quills and flat pieces (from Cadiz in 1814)	30 grs.	32 grs.
	{ 2. Flat pieces (from Curaçao in 1806)	36 grs.	5 grs.
Goebel and Kirst	found 56 grs. of Quina, and 43 grs. of pure Cinchonina.		

The bark analyzed under the name of *Carthagena cinchona*, by Pelletier and Caventou,¹ was *Carthagena brown cinchona*² (see *Pitaya Condaminea bark*, p. 663.)

Gelatine occasions no precipitate in the infusion; tincture of galls produces turbidity; sesquichloride of iron a green colour.

MEDICINAL PROPERTIES.—These are greatly inferior to those of Calisaya bark, though, according to Weddell, Mutis declares that “Ea est species, quæ Chinæ auctoritatem perditam restituet, et quæ a tempore ejus introductionis, a. 1742, in medicina singulare pretium obtinuit.”

XII. CORTEX CINCHONÆ DE MARACAIBO.—MARACAIBO BARK.

In 1831, Mr. Carpenter,³ of Philadelphia, published some observations on a new variety of cinchona bark, called *Maracaibo bark*. In 1841, M. Guibourt met with, in commerce, large quantities of *Maracaibo cinchona* (quinquina de Maracaibo).

I have found in English commerce three barks under the name of “Maracaibo bark:”—

1. A root-bark which was given to me by Mr. J. E. Howard as “curly Maracaibo bark,” and to which I have already referred (see *New Granada Cinchona Root-bark*, p. 649). It contains cinchonine.

2. A stem-bark consisting of short broken twisted quills and flat pieces, rarely more and usually less than three inches long. Some of the quills are entirely uncoated, and consist exclusively of liber. Other quills and flat pieces are partially covered externally by a grayish-white coat. This variety contains very little alkaloid, and is closely allied in appearance to the bark of *Cinchona cordifolia*. This probably is the sort referred to by Mr. Carpenter.

3. A very coarse powder or small fragments of the liber of a very bitter friable bark.

TABLE OF COMMERCIAL CINCHONA BARKS,

WITH THE BOTANICAL SPECIES FROM WHICH THEY ARE PRESUMED TO BE OBTAINED.

Name.	Remarks.	Botanical Species.
1. Genuine Calisaya or Yellow Bark (<i>Cinchona flava</i> [regia], Ph. Lond.)	Monopoly bark may be taken as the type	1. <i>Cinchona Calisaya</i> var. <i>α vera</i> , Weddell.
2. Josephian Calisaya Bark (<i>Ichu-Cascarilla</i> ; <i>Cascarilla del Pajonal</i> , Boliv.)	Sold as Calisaya barks. Strictly speaking, they are false Calisaya barks	2. <i>C. Calisaya</i> var. <i>β Josephiana</i> , Wedd.
3. Bolivian Mulberry Calisaya (<i>Cascarilla morada</i> , Boliv.)		3. <i>C. Boliviana</i> , Wedd.
4. <i>Cascarilla-Carabaya</i> ; <i>Zamba morada</i> , Peruv.	Except No. 7, these barks are not distinguished by any special names in English commerce; but are usually known as spurious or false Calisaya barks. In France, the designation of <i>Calisaya léger</i> (light or flimsy Calisaya) is given to some of them (e. g. to Nos. 3, 5, and 6)	4. <i>C. ovata</i> var. <i>β rufinervis</i> , Wedd.
5. <i>Cascarilla provinciana</i> , Ihuancu; <i>C. monticola</i> , Carabaya; <i>Quepo-Cascarilla</i> , Boliv.		5. <i>C. micrantha</i> , Wedd.
6. <i>Cascarilla Colorada del Cuzco</i> ; <i>Cascarilla de Santa-Ana</i> , Peruv.		6. <i>C. scrobiculata</i> var. <i>α genuina</i> , Wedd.
7. Peruvian Calisaya		7. <i>C. scrobiculata</i> var. <i>β Delondriana</i> , Wedd.
8. <i>Cascarilla-Echenique</i> , Peruv.; <i>Cascarilla-Quepo</i> , Boliv.	Nos. 3, 5, and 6)	8. <i>C. arygdalesifolia</i> , Wedd.
9. Carabaya Bark	This is not to be confounded with No. 4	9. <i>C. ovata</i> var. <i>α vulgaris</i> , Wedd.
10. Cuzco Bark (<i>Carua-carua</i> , Peruv.; <i>Cascarilla</i> -or <i>Quina-amarilla</i> , Carab.)	This is not to be confounded with the red Cuzco bark, No. 6	10. <i>C. pubescens</i> var. <i>α Pelletieriana</i> , Wedd.

¹ Journ. de Pharm. vii. 101.

² Guibourt, *Hist. des Drog.* ii. 96.

³ Silliman's American Journal of Science and Arts, vol. xx. p. 2, 1831.

TABLE OF COMMERCIAL CINCHONA BARKS—continued.

Name.	Remarks.	Botanical Species.
11. <i>Cascarilla morada</i> , Ruiz; <i>Cascarilla boba de hojas moradas</i> , Huanuco	Occasionally imported with No. 10, and not distinguished by name from it.	11. <i>C. pubescens</i> var. <i>purpurea</i> , Wedd.
12. Gray Bark; Huanuco or Lima Bark (<i>Cinchona cinerea</i> , Ph. Ed.):— a. Fine Gray Bark (<i>Quinquina rouge de Lima</i> , Guib.) b. Inferior or Coarse Gray Bark (<i>Quinquina de Lima gris brun</i> , Guib.)	These two sorts of gray bark are not distinguished in English commerce; they are usually imported mixed together, but are sometimes brought over separately	12. a. <i>C. nitida</i> , Ruiz and Pavon b. <i>C. micrantha</i> , Wedd.
13. Huamalies Bark; Rusty Bark		13. <i>C. Condaminea</i> var. <i>Chahuargueta</i> , De Cand.?
14. Ash Bark (<i>Quinquina de Loza cendré A</i> , Guib.; <i>Blasse Ten-China</i> , Bergen)	Not to be confounded with ashy crown bark (No. 18)	14. <i>C. ovata</i> var. <i>a. vulgaris</i> , Wedd.
15. Original or True Crown Bark (<i>Cinchona pallida</i> [<i>de Loza</i>], Ph. L.; <i>Cinchona coronata</i> , Ph. Ed.)		15. <i>C. Condaminea</i> var. <i>vera</i> , Wedd.
16. White Crown Bark		16. <i>C. Condaminea</i> var. <i>lucunafolia</i> , Wedd.
17. H. O. Crown Bark	In commerce, these barks are called <i>Loza</i> or <i>Crown Barks</i>	17. <i>C. glandulifera</i> , Ruiz and Pavon?? 18. <i>C. cordifolia</i> var. <i>rotundifolia</i> , Wedd.?
18. Ashy Crown Bark (<i>Quinquina de Loza cendré B</i> , Guib.; <i>Dunkela Ten-China</i> , Bergen)		19. <i>C. hirsuta</i> , Ruiz and Pavon?
19. Wiry Loza Bark		20. <i>C. —?</i>
20. Red Bark (<i>Cinchona rubra</i> , Ph. Lond.)		21. <i>C. Condaminea</i> var. <i>Pitagensis</i> , Wedd.
21. Pitaya Condaminea Bark (<i>Quinquina Pitaya</i> , Guib.)	Not distinguished by name in English commerce	22. <i>C. Condaminea</i> var. <i>lanceifolia</i> , Wedd.
22. Fibrous Cartagena Bark (<i>Quinquina orangé de Mutis</i> , Guib.)	The <i>Coquetta</i> or <i>Bogota Bark</i> is a variety of this	23. <i>C. cordifolia</i> var. <i>vera</i> , Wedd.
23. Hard Cartagena Bark (<i>Quina amarilla</i> , Mutis)	This and the preceding bark are called <i>Cartagena Bark</i> in English commerce	24. <i>C. cordifolia?</i>
24. Maracaibo Bark, No. 2		25. <i>C. calisaya</i> var. <i>Josephiana</i> , Wedd.
25. Bolivian Cinchona Root Bark	Both these root barks are in short, contorted, twisted pieces	26. <i>C. —?</i>
26. New Granada Cinchona Root Bark; Curly Maracaibo Bark		

The barks enumerated in the above table, and which have been previously described, yield very unequal quantities of the cinchona alkaloids, and, therefore, in a medicinal point of view, are of very different qualities. The following are, according to M. Guibourt, the most active barks:—

1. Calisaya bark.
2. Orange-yellow [includes *C. micrantha*, see *ante*, p. 649].
3. Pitaya [Pitaya Condaminea, see *ante*, p. 662].
4. Red genuine, verrucous [see *ante*, p. 662].
5. Red genuine, non-verrucous [see *ante*, p. 662].
6. Red Lima [Fine Gray, see *ante*, p. 655].
7. Gray Lima [Inferior Gray, see *ante*, p. 655].
8. Huamalies, white verrucous [see *ante*, p. 656].

COMPOSITION.—In February, 1791, Fourcroy¹ published an analysis of *St. Lucia* or *St. Domingo bark* (a false cinchona bark, yielded by *Ecstemma floribundum*), which was long regarded as a model of vegetable analysis. In 1802, Seguin² concluded that, as the active principle of cinchona was precipitated by an infusion of nutgalls, it must be gelatine; and therefore proposed and employed the use of clarified glue as a febrifuge in intermittents! In 1803, Dr. Duncan, jun.³ showed that the active principle could not be gelatine, but must be a substance *sui generis*, which he therefore termed *cinchonina*. In 1806, Vauquelin⁴ published some experiments on seventeen kinds of cinchona. In 1810, Gomes⁵ succeeded in isolating

¹ *Ann. de Chim.* viii. 113, and ix. 13.² *Nicholson's Journal*, vi. 225.³ *Ann. de Chim.* xcii. 121; and xci. 273 and 304.⁴ *Ann. de Chim.* lix. 113.⁵ *Mem. da Acad. Real das Sciencias de Lisboa*, iii. 201; and *Ed. Med. and Surg. Journ.* vii. 420.

cinchonia, and obtaining it in a crystalline form. In 1820, Pelletier and Caventou¹ announced the existence of two cinchona alkaloids—*cinchonia* and *quinia*—in cinchona bark. In 1829, Pelletier and Coriol² discovered a third cinchona alkaloid—*aricina*—in a new sort of cinchona bark, which they termed *Arica bark* (the bark of *Cinchona pubescens* var. *a. Pelletieriana*, Weddell). In the same year (1829), Serturner³ gave the name of *quinoidine* (chinoidine) to another supposed peculiar alkaloid contained in yellow and red barks; the existence of which, however, was denied by Henry fils and Delondre.⁴ In 1833,⁵ the last-mentioned chemists announced a new cinchona alkaloid, called *quinidine*, which they obtained from yellow bark, and which was doubtless contained in Serturner's quinoidine; but, finding its composition to be identical with quinia, they subsequently⁶ stated that their supposed new alkaloid, quinidine, was nothing else than hydrate of quinine. In 1846, Liebig⁷ declared that a considerable portion of the resinous-looking body called quinoidine, which the makers of sulphate of quinine obtain from their mother waters, was *amorphous quinine*, and bore the same relation to ordinary quinine that barley-sugar does to sugar-candy. In 1849, a Dutch chemist, Van Heijningen,⁸ submitted quinoidine to a careful examination, and found in it *quinidine*, or, as he termed it, β *quinine*; and the year following (1850) he obtained from it another alkaloid, which he called γ *quinine*.⁹

The organic constituents of the cinchona barks, as determined by Pelletier and Caventou, and subsequently by other chemists, are *quina*, *cinchonia*, *aricina*, *quinidine*, *kinic*, *tannic*, and *kinovic acids*, *cinchona red*, *yellow colouring matter*, *green fatty matter*, *starch*, *gum*, and *lignin*.

Puttfarcken¹⁰ found that, by incineration, the cinchona barks yielded from 0.58 (yellow or Calisaya bark) to 3.4 (ash cinchona) per cent. of ashes, the chief constituent of which was carbonate of lime. Some barks (*e.g.* Calisaya and Huanuco) yielded ashes of a green colour, owing to the presence of manganate of potash. Puttfarcken's results favour the opinion that with the increase of the alkaloids in the barks, the proportion of lime diminishes.

1. **VOLATILE OIL OF CINCHONA BARK** (*Odorous, Aromatic, or Balsamic Principle*).—This was procured first by Fabbroni,¹¹ afterwards by Trommsdorff.¹² It was obtained by submitting bark with water to distillation. The distilled water had the peculiar odour of the bark, and a bitterish acrid taste. The oil which floated on the water was thick and butyraceous, and had the peculiar odour of the bark, and an acrid taste. From 20 lbs. of bark, Trommsdorff obtained two grains of oil. Zenneck¹³ says the cinchona odour is imitated by a solution of turmeric in potash, as well as by chloride of iron.

2. **CINCHO-TANNIC ACID** (*Tannic Acid; Astringent Principle; Soluble Red Colouring matter*).—Cincho-tannic acid differs from the tannic acid of nutgalls in being less astringent, in yielding a green colour or precipitate with the salts of the sesquioxide of iron, and in the remarkable facility with which its solution absorbs the oxygen of the air, especially under the influence of alkalies. Furthermore, the compounds which it forms with acids are more soluble than those of the nutgall tannic acid. According to Schwarz,¹⁴ the formula of the hydrate of cincho-tannic acid is $C^{14}H^6O^7 + 2HO = C^{14}H^8O^9$. The products of the oxidation of this acid are, according to the same authority, 1 eq. of cinchona red, $C^{12}H^7O^7$, 2 eq. of carbonic acid, $2CO_2$, and 1 eq. of water, HO . So that it must absorb 3 eq. of oxygen.

3. **CINCHONA RED** (*Red Cinchonic; Insoluble Red Colouring Matter*).—Berzelius¹⁵ and Schwartz regard this substance as a product of the oxidation of cincho-tannic acid. It is an inodorous, insipid, reddish-brown substance, insoluble or nearly so in cold water, somewhat more soluble in hot water, but readily soluble in alcohol and alkalies. As obtained by Schwartz, it also dissolved easily in ether. Acids favour its solution in water. Its alkaline solution is intensely red. Dried at 212° , Schwartz found it to consist of $C^{12}H^7O^7$.

In the previous edition of this work, I expressed an opinion that red cinchonic resembled in most of its properties catechuic acid (catechine) which is found in abundance in another genus

¹ *Journ. de Pharm.* t. vii. p. 49, 1821.

² *Ibid.* t. xvi. p. 44, 1830.

³ *Ibid.* t. xix. p. 623, 1833.

⁴ *Lancet*, p. 585, May 23, 1846; *Ann. d. Chim. u. Pharm.* Bd. lviii. S. 348, 1846.

⁵ *Pharmaceutical Journal*, vol. ix. p. 322, 1850.

⁶ *Ibid.* vol. xi. p. 129, 1851.

⁷ *Chemist's Report*, Bd. xviii. S. 223, 1824.

⁸ *Pharmaceutical Journal*, vol. xii. p. 17, 1852.

⁹ *Ibid.* t. xv. p. 565, 1829.

¹⁰ *Ibid.* t. xvi. p. 144, 1830.

¹¹ *Ibid.* t. xx. p. 157, 1834.

¹² *Ibid.* vol. xi. p. 521, 1852.

¹³ *Berl. Jahrb.* 1807.

¹⁴ *Pharm. Central-Blatt für 1852*, S. 236.

¹⁵ *Traité de Chimie*, t. v. p. 585, 1831.

of cinchonaceous plants (see *Uncaria Gambir*). Pelouze and Frémy¹ assert that "the tannin contained in cinchona is nothing else than catechuic acid, and red cinchonic is a product of its oxidation which precedes the formation of rubinic acid."

4. **KINIC ACID** (*Cinchonic or Quinic Acid*). $C^7H^4O_4 \cdot 2HO$.—Exists in cinchona barks in combination probably with the cinchona alkaloids and with lime. It crystallizes from its aqueous solution in prisms with rhombic bases. Its presence may be most readily detected by converting it into *kinone* ($C^{12}H^4O^4$). This is done by submitting the substance supposed to contain kinic acid to distillation with peroxide of manganese and sulphuric acid; the kinone distils over. It is a yellow crystallizable substance, soluble in water, and having a pungent odour. If its watery solution be treated with ammonia, it absorbs oxygen from the air, and becomes first brown, and finally black, owing probably to the formation of melanic acid ($C^{12}H^4O^4 + 2O = C^{12}H^4O^6$). If chlorine water be added to another portion of the solution of kinone, the liquid assumes a bright green colour. Dr. Stenhouse² has proposed to detect the presence of kinic acid in cinchona bark by converting it into kinone.

5. **KINOVIC ACID** (*Kinova Bitter; Chioceic Acid*). $C^{12}H^8O^9$.—Has been found in Calisaya bark, as well as in the false cinchona bark called *quinquina nova*. It exists in the latter bark most probably in combination with lime.³ It is a white amorphous substance, almost insoluble in water, but readily soluble in alcohol and ether. A solution of the kinovate of magnesia yields precipitates (*kinovates*) with solutions of acetate of lead, bichloride of mercury, and the salts of cinchona. Kinovic acid is devoid of febrifuge power.⁴

6. **CINCHONA ALKALOIDS**.—Three alkaloids obtained from genuine cinchona barks have been used in medicine; viz. *Quina*, *Cinchonia*, and *Quinidina*. *Aricina*, another but imperfectly known cinchona alkaloid, has not hitherto been applied to medicinal purposes.

The cinchona alkaloids exist in cinchona bark in combination with one or more acids; probably with kinic and tannic acids; according to Henry fils and Plisson,⁵ with kinic acid and cinchona red. They reside chiefly in the liber.

Cinchonia, quina, and aricina, were regarded by Pelletier as being respectively the monoxide, binoxide, and teroxide of an hypothetical nitrogenous base, which he called *quinogen*, and whose formula is $C^{20}H^{12}N$.

The following are the formulæ and equivalents for those cinchona alkaloids which have been best studied:—

<i>Cinchona Alkaloids.</i>	<i>Formulæ.</i>	<i>Equivalents.</i>	<i>Authority.</i>
Quinidina	$C^{36}H^{22}N^2O^{12}$	216	Leera.
Quina	$C^{24}H^{14}N^2O^8$	300	Laurent.
	$C^{20}H^{12}N^2O^7$	162	Liebig.
Cinchonia	$C^{36}H^{22}N^2O^{12}$	284	Laurent.
	$C^{16}H^{10}NO$	154	Liebig.

TABLE, SHOWING THE PERCENTAGE AMOUNT OF ALKALOIDS OBTAINED FROM THE OFFICIAL BARKS OF THE BRITISH PHARMACOPŒIAS.

100 Parts of Bark.	Quina.	Quinidina.	Cinchonia.	Total Alkaloid.	Authority.
CALISAYA:—					
Average produce (see p. 648)	2.2 to 2.6	...	...	...	Pelletier and Souberran.
Uncoated thick flat pieces	2.14	...	...	...	Winckler.
Best sort	3.8	...	...	...	Riegel.
Var. <i>β Josephiana</i>	3.29	...	...	...	Riegel.
RED BARK:—					
Best sort	2.65	...	1.51	4.16	Riegel.
Large broad flat pieces . . . . .	...	...	...	3.85	Riegel.
Dark heavy flat-coated pieces	0.104	...	2.34	...	Winckler.
Pale thin flat pieces	0.078	...	1.04	...	Winckler.
LOXA OR CROWN:—					
Fine old Loxa quills, in bundles	0.714	0.514	0.04	1.268	J. E. Howard.
Finest Crown	0.52	...	0.42	0.94	Riegel.
H. O. Crown, fine sample, 1850 . . . . .	...	0.57	0.06	0.63	J. E. Howard.
Ditto ditto 1851 . . . . .	...	1.05	0.08	1.13	J. E. Howard.
Ashy Crown, from Lima . . . . .	...	0.5	0.914	1.414	J. E. Howard.
Ashy Crown, mixed with Ashy Crown from Lima . . . . .	...	0.4 (chiefly quinidina)	0.255	0.655	J. E. Howard.
GRAY OR HUANUCO:—					
Fine gray	0.571	0.112	1.4	2.113	J. E. Howard.
Inferior or coarse gray	0.213	0.28	1.25	1.773	J. E. Howard.
Strong middling-sized quills . . . . .	...	...	2.5	...	Winckler.

¹ *Cours de Chimie Générale*, t. iii. p. 171, 1850.

² *Memoirs of the Chemical Society of London*, vol. ii. p. 226, 1845.

³ Illasiwetz, *Chemical Gazette*, vol. ix. p. 441, Dec. 3, 1851.

⁴ Weil, *Bu. hner's Repertor*, 2te Reihe, Bd. iii. S. 396, 1835.

⁵ *Journal de Pharmacie*, t. xiii. pp. 269 and 369, 1827.

1. QUINA.

Quina; Quinininum; Chininum; Quinine. Formula $C^{38}H^{22}N^2O^4$ (Laurent).¹ Eq. 370.

Symb Qn^+ .—Discovered in 1820, by Pelletier and Caventou. It is a probable constituent of all genuine cinchona barks, but especially of the genuine yellow bark (*Cinchona Calisaya*), from which it is chiefly obtained. It is also procured by chemical manufacturers from the cheaper but inferior cinchona barks of Carabaya, Bolivia, and New Granada.

The simplest, readiest, and cheapest mode of procuring quina is by adding ammonia to a solution of the sulphate of quina and collecting and drying the precipitated quina.

As usually procured, quina is in the form of a whitish, porous mass. Pelletier crystallized it by dissolving it in alcohol of sp. gr. 0.815, and setting the solution aside to evaporate spontaneously in a dry place. Liebig obtained it from a somewhat ammoniacal watery solution, in the form of fine silky needles. Quina crystallized from its aqueous solution is a *hydrate*, and has for its formula $Qn, 6HO=C^{38}H^{22}N^2O^4, 6HO$.

Quina is inodorous, very bitter, and fusible at about 300° F. The fused mass, when cold, is yellow, translucent, friable, and somewhat like resin in appearance. One part of quina requires about 400 parts of cold water, or 250 parts of boiling water, or 2 parts of boiling alcohol and 60 parts of cold ether, to dissolve it. The aqueous and alcoholic solutions react as an alkali. Dissolved in either alcohol or acidulated water, quina possesses the property of left handed rotatory polarization. At a temperature above 72° F. this rotatory power decreases.

When quina is distilled with excess of potash, an oily liquid base, called *quinoline* or *cincholine*, $C^{18}H^7N$, is obtained. Some other organic bases, as cinchonina, and strychnia, also yield, when distilled with potash, the same product. Dr. Stenhouse² has proposed to detect the presence of an alkaloid in bark by this test.

Quina and its salts may be readily detected by the following test: if the alkaloid or its salt be diluted with water, and chlorine water be then added, the alkaloid is dissolved without producing any remarkable effect. But if ammonia be now added, the liquid acquires a grass-green colour.³ By this colour quina may be distinguished from cinchona and quinidina. If a substance suspected to contain quina be powdered, then shaken with ether, and afterwards successively treated with chlorine and ammonia, the liquid will assume a green colour if the slightest trace of quina be present.

The *salts of quina* are of two classes, one termed *neutral*, the other *acid*; the former contain one, the latter, two, equivalents of acid to each equivalent of base.⁴ They are for the most part readily crystallizable, very bitter, and of a pearly aspect. The less soluble salts are the *oxalate*, the *tartrate*, the *tannate*, and *ferrocyanate*. The soluble salts are more bitter than the corresponding salts of cinchonina. They yield precipitates on the addition of tannic acid (or tincture of nutgalls), ammonia, bichloride of mercury, and bichloride of platinum. Hyposulphite of soda causes a white crystalline precipitate (*hyposulphite of quina*) when added to a solution of hydrochlorate of quina. According to Winckler,⁵ neither amorphous quina nor amorphous cinchonina, when saturated with hydrochloric acid, yield any precipitate with the hyposulphite of soda.

The following is the composition of quina:—

	Atoms.	Eq. Wt.	Per Cent.	Laurent.	Liebig.	Pelletier and Dumas.
Carbon	38	228	73.54	73.54	74.40	75.02
Hydrogen	22	22	7.09	7.07	7.61	6.66
Nitrogen	2	28	9.03	—	8.11	8.45
Oxygen	4	32	10.33	—	9.83	10.43
Anhydrous Quina .	1	310	99.99	100.00	100.00	100.56

AMORPHOUS QUINA.—A supposed uncrystallizable form of quina contained in the mother-liquors from which sulphate of quina has crystallized, and which is usually found in the substance called *quinoidine*. Liebig⁶ considers that it bears the same relation to crystallizable quina that barley-sugar does to sugar-candy; and Winckler⁷ states that ordinary quina may be rendered amorphous by the action of acids. He farther informs us that the amorphous cinchona

¹ Ann. de Chim. et de Phys. 3d Ser. t. xix. pp. 359—377, 1847. Liebig's formula is $C^{30}H^{12}NO^3$: equiv. 162.

² Memoirs of the Chemical Society, vol. ii. p. 227, 1845.

³ Mescon (by mistake printed Roper), in the Lond. Med. Gaz. vol. xi. pp. 320 and 362; also in the Phil. Mag. Feb. 1835; Andre, Journ. de Pharm. xxii. 127, 1836. The green product of the action of chlorine and ammonia on quina has been called by Brandes and Leber (Pharm. Central-Blatt für 1838, p. 875), *dal-laochin*, $C^{32}H^{16}NO^3$ (more properly *thalliochin*, from *Thallion*). They also mention two other products of decomposition; one termed *melanochin*, and the other *rustiochin*.

⁴ It Liebig's formula for quina be adopted, the above two classes of salts would be called respectively *basic* and *neutral*, although the latter possess an acid reaction. The duplication of the equivalent for quina, as suggested by Regnault, necessarily alters the nomenclature of the salts.

⁵ Chemical Gazette, vol. vi. p. 122, 1848.

⁶ Chemical Gazette, vol. vi. p. 121, 1848.

⁷ Lancet.

alkaloids (quina and cinchonia) may be distinguished and separated from the crystalline alkaloids by hyposulphite of soda, which precipitates the latter, from their muriatic solution, in the form of crystalline hyposulphites, but occasions no precipitate with corresponding solutions of the amorphous alkaloids.

Some doubts, however, still exist as to the real nature of the so-called amorphous quina. Roder¹ declares that it is merely ordinary quina combined with a resin; while Van Heijningen² resolved the so-called quinoidine into ordinary quina, cinchonia, quinidina, and a resinous substance.

Dilute solutions of quina (especially an acidulated aqueous solution of the commercial sulphate) exhibit in certain aspects a peculiar celestial blue colour. This property has been designated, by Professor Stokes,³ *fluorescency*. Sir John Herschel⁴ considered it to be a case of *superficial*, or, as he termed it, *epipolic* (from ἐπιπολή, a *surface*) *dispersion*. Sir D. Brewster,⁵ however, showed that the effect was not confined to the surface, but extended to a considerable depth into the body of the liquid, and he, therefore, regarded it as a particular case of *internal dispersion*. More recently, Professor Stokes has shown reason for concluding that in this process of true internal dispersion the chemical or invisible rays of the spectrum, which are more refrangible than the violet rays, change their refrangibility, thereby becoming visible, and produce the blue superficial light in question.⁶

1. QUINÆ SULPHAS (*Quina Disulphas*, Ph. Lond.). See *post*.

2. QUINÆ BISULPHAS. Formerly called *Neutral Sulphate of Quina*. Formula⁷ (Qn, HO), $2\text{SO}_3 + 16\text{HO} = (\text{C}^{35}\text{H}^{22}\text{N}^2\text{O}^4, \text{HO}), 2\text{SO}_3 = 16\text{HO}$. Eq. weight 543.—This salt is readily formed by adding sulphuric acid to the sulphate. It is sometimes produced in the manufacture of the latter salt, and remains, on account of its greater solubility, in the mother liquor, with the sulphate of cinchonia. It crystallizes in rectangular prisms or silky needles, reddens litmus, and dissolves in about 11 parts of water at ordinary temperatures, and also in spirits of wine. When heated, it melts in its water of crystallization, and at 212° loses, according to both Bamp and Liebig, 24.6 per cent. of water. It is distinguished from the ordinary sulphate by its acid reaction and its greater solubility in water. Its solution is fluorescent, and possesses the property of left-handed rotatory polarization. With sulphate of the sesquioxide of iron it forms a double salt, which crystallizes in octohedra resembling those of alum.

2. CINCHONIA.

Cinchonine; *Cinchonina*; *Cinchoninum*. Formula $\text{C}^{38}\text{H}^{22}\text{N}^2\text{O}^2$, Laurent⁸ Equiv. 294. Sym. bol^{\dagger} .—Its presence was inferred in 1803 by Dr. Duncan, Jun.; but Gomes first succeeded in obtaining it in 1810. It is a probable constituent of all genuine Cinchona barks, but is met with most abundantly in Cusco and Gray barks. It is obtained from the sulphate of cinchonia in the same way that quina is procured from its sulphate.

Cinchonia readily crystallizes from its alcoholic solution. The crystals are anhydrous, colourless, inodorous, and bitter, though less so than quina. Their shape is that of a four-sided prism, with oblique terminal facets. It fuses, but with more difficulty than quina, and, by the cautious application of heat, it is volatilized, and yields a crystalline sublimate. During its sublimation, it evolves an aromatic odour (by which, according to Liebig, it is distinguished from quina). Heated with potash, it yields cinchonine.

It is less soluble in water, alcohol, and ether, than quina. Thus, cold water scarcely dissolves any of it, and boiling water takes up only $\frac{1}{2500}$ th part of its weight. It is somewhat soluble in spirit of wine, and the more so in proportion as the spirit is stronger and its temperature higher. According to Duflos, strong spirit of wine dissolves only 3 per cent. of its weight of cinchonia. In ether it is insoluble, and by this property it is both distinguished and separated from quina. Cinchonia, dissolved either in alcohol or in acidulated water, possesses the property of right-handed rotatory polarization, and is thereby distinguished from quina, whose rotation is left-handed.

Cinchonia or its salts dissolves in chlorine water without undergoing any obvious change. In this respect it agrees with quina or quinidina. But if ammonia be added to the solution, a white precipitate is produced. By this latter character cinchonia is distinguished from both quina and quinidina.

¹ *Pharmaceutical Journal*, vol. viii. p. 295, 1848.

² *Philosophical Transactions* for 1852.

³ *Edinburgh Transactions*, vol. xvi. part ii. 1846; also *Lond. Edinb. and Dubl. Philosoph. Mag.* for June, 1848.

⁴ For an abstract on the views of Herschel, Brewster, and Stokes, see the *Pharmaceutical Journal*, vol. xii. p. 245, 1852.

⁵ Regnault (*Cours Élément. de Chimie*, 2me édit. 4me part. p. 720, 1850), gives the following formula for this salt: $(\text{C}^{35}\text{H}^{22}\text{N}^2\text{O}^4, \text{HO}), 2\text{SO}_3 + 16\text{HO}$. This would give only 15 per cent. for the water of crystallization. It is probable, therefore, that the " HO " is a misprint for " 16HO ."

⁶ *Ann. der Chemie u. Pharm.* Bd. lxii. p. 99, 1847.—Liebig's formula for it is $\text{C}^{37}\text{H}^{21}\text{N}^2\text{O}$, and its corresponding equivalent 154.

⁷ *Ibid.* vol. ix. p. 322, 1850.

⁸ *Ibid.* for 1845.

Of the salts of cinchonia those which are interesting in a medicinal point of view are the two sulphates.

1. CINCHONIÆ SULPHAS; *Sulphate of Cinchonia*; *Cinchoniæ Disulphas*. Formula $(\text{C}_i\text{H}_7\text{O})_2\text{SO}_4 \cdot 2\text{H}_2\text{O} = (\text{C}^{38}\text{H}^{22}\text{N}^2\text{O}^2\text{HO})_2\text{SO}_4 + 2\text{H}_2\text{O}$. Eq. weight 361. The sulphate of cinchonia of commerce is usually obtained from the mother waters from which sulphate of quina has crystallized. The crystals of this salt are short, oblique prisms, terminated by dihedral summits. Its taste is bitter. When heated it becomes phosphorescent; at 212° it fuses; at 248° F. it loses its water of crystallization. At ordinary temperatures it is soluble in $6\frac{1}{2}$ parts of alcohol of sp. gr. 0.85, and in $11\frac{1}{2}$ parts of absolute alcohol. It requires 54 parts of cold water to dissolve it. Its solution possesses the property of right-handed rotatory polarization; and is not fluorescent. By these properties it is distinguished from the sulphates of quina and quinidine. In ether it is insoluble.

2. CINCHONIÆ BISULPHAS; *Bisulphate of Cinchonia*. Formerly called the *Neutral Sulphate of Cinchonia*. Formula $(\text{C}_i\text{H}_7\text{O})_2\text{SO}_3 \cdot 8\text{HO} = (\text{C}^{38}\text{H}^{22}\text{N}^2\text{O}^2\text{HO})_2\text{SO}_3 + 8\text{HO}$. Eq. Weight 455. —Obtained by dissolving the sulphate in water acidulated with sulphuric acid, and evaporating the solution so that crystals may form. These are rhomboidal octohedra, which, in dry air, become opaque and efflorescent. When heated, they lose their water of crystallization. At ordinary temperatures 100 parts of this salt dissolve in 46 parts of water, in 90 parts of spirit-wine, sp. gr. 0.85, or in 100 parts of absolute alcohol. It is insoluble in ether. The optical properties of a solution of this salt resemble those of a solution of the neutral sulphate of cinchonia.

3. QUINIDINA.

Quinidin or *Quinidine*; *Chinidin*; β *Quinine*; *Cinchotin*. Formula $\text{C}^{36}\text{H}^{22}\text{N}^2\text{O}^2$. (Leers) Eq. Weight 282; $\text{C}^{20}\text{H}^{12}\text{NO}^2$ Van Heijningen, Hlasiwetz. Symbol Qdn.—In 1833, Henry and Delandré¹ discovered this alkaloid, to which they gave the name of *quinidine*; but, in the following year,² they declared it to be identical with quina. It is probable, however, that Bucholz³ in 1822, and Thiel⁴ in 1823, had actually obtained it, though in an impure form. In 1848, Van Heijningen⁵ recognized it as a peculiar base which possessed the same composition as quinine. He, therefore, called it β *quinine* to distinguish it from ordinary quinine, which he termed α *quinine*. His statement as to its composition was confirmed in 1850 by Hlasiwetz,⁶ who called it the alkaloid *cinchotin*. Winckler,⁷ in 1848, gave a description of it and of some of its salts; and, in 1852, Leers⁸ published a very elaborate account of its salts.

It is found in many, perhaps in most, of the genuine *Cinchona* barks; especially in *lancifolia*, *acuta*, *cordifolia*, and *amygdalifolia* barks.⁹ It is obtained from them by the same process as that by which quina is procured from the quina-yielding barks; but its sulphate being more soluble than sulphate of quina, is left in the mother waters. In order to obtain the alkaloid pure it is to be repeatedly crystallized from its alcoholic solution to deprive it of a greenish yellow resinous substance, and then shaken with ether, to remove any adherent quina, until the ethereal liquor no longer indicates the presence of quina by yielding a green colour on the addition first of chlorine water, and afterwards of ammonia.

Quinidina readily crystallizes by the spontaneous evaporation of its solution in alcohol. The crystals are anhydrous, colourless, hard prisms, with a vitreous lustre. Their taste is bitter, but less so than that of quina. When heated in a platinum crucible over the flame of the spirit-lamp they at first retain their shape and lustre, and then fuse, without either decomposing or giving out water, at 347° F., and form a clear wine yellow liquid, which, by cooling, congeals into a whitish-gray crystalline mass. If the heat be raised above 347° , the liquor takes fire and burns with a very sooty flame, and evolves an odour of quinole and of oil of bitter almonds. One part of quinidina is soluble in 2580 parts of water at $62\frac{1}{2}^\circ$ F., or in 1858 parts of boiling water, or in 12 parts of alcohol, sp. gr. 0.835 at $62\frac{1}{2}^\circ$ F. (in boiling spirit it is freely soluble) or in about 142 parts of ether at $62\frac{1}{2}^\circ$ F. From both its alcoholic and ethereal solutions it readily crystallizes.

A solution of quinidina in acidulated water agrees with one of quina, both in possessing the property of left-handed polarization, and in being fluorescent. These properties distinguish it from a solution of cinchonia.

If the solution of quinidina be treated first with chlorine water and then with ammonia, it

¹ *Journ. de Pharm.* t. xix. p. 623, 1833.

² *Transsudorff's Journ. der Pharm.* Bd. vi. p. 94, 1822.

³ *Ibid.* t. xx. p. 157, 1834.

⁴ *Georg's Magazin der Pharm.* I. Jahrg. Bd. ii. p. 79, 1823.

⁵ *Pharmaceutical Journal*, vol. ix. p. 322, 1850.

⁶ *Chemical Gazette*, vol. ix. p. 90, 1851.

⁷ *Pharmaceutical Journal*, vol. vii. p. 527, 1848. Some other notices of quinidine by Winckler will be

found in the same journal, vol. iv. p. 168, 1845, and the *Chemical Gazette*, vol. vi. p. 161, 1845.

⁸ *Pharmaceutical Journal*, vol. xii. 1852.

⁹ Winckler obtained it from a bark which he says somewhat resembled Huamalies bark. This probably was *Cinchona* bark.

does not become green like a solution of quina. It either yields a white precipitate like a solution of cinchonina, or, when a considerable excess of chlorine has been used, remains apparently unchanged.

The salts of quinidina are, for the most part, more soluble in water than those of quina. They readily dissolve in spirit of wine, but scarcely at all in ether. Like those of quina and cinchonina the salts of quinidina are of two kinds, the one neutral, the other acid salts.

1. QUINIDINÆ SULPHAS; *Sulphate of Quinidine*. Formula $\text{Qdn}.\text{SO}^4\text{H}.\frac{1}{2}6\text{aq.} = (\text{C}^{26}\text{H}^{22}\text{N}^2\text{O})_2.\text{SO}^4\text{H}.\frac{1}{2}6\text{aq.}$ Eq. Weight 403.—This salt crystallizes in long, silky, shining, acicular crystals, which dissolve in 130 parts of water at $62\frac{1}{2}^\circ\text{F.}$, or in 16 parts of boiling water. It is readily soluble in two parts of rectified spirit; but it is almost insoluble in ether. Zimmer² states that in dry warm air it parts with its water of crystallization without delinquency or losing its crystalline aspect. Its aqueous solution agrees with a solution of sulphate of quina, in being fluorescent, and in possessing the property of left-handed rotatory polarization.

In appearance, this salt closely resembles sulphate of quina. Winckler,³ indeed, says it is undistinguishable from the latter salt; but Zimmer states that it differs from the latter in having a greater sp. gravity and less flocculent crystallization. It appears to me also to have a more vitreous lustre. It differs also in its much greater solubility both in water and in rectified spirit. Moreover, if its solution be successively treated with chlorine-water and ammonia, it does not yield a green colour as a solution of sulphate of quina.⁴ Furthermore, if a solution of sulphate of quinidina be decomposed by ammonia, the precipitated alkaloid (quinidina) may be readily distinguished from quina by its more difficult solubility in ether (see *Quina Sulphas*).

From sulphate of cinchonina, the sulphate of quinidina is readily distinguished by the appearance of its crystals, by the difference of its solubility in water, in alcohol, and in ether, and by its solution being fluorescent and possessing the property of left handed rotatory polarization.

2. QUINIDINÆ BISULPHAS; *Bisulphate of Quinidine*; *Acid Sulphate of Quinidine*. Formula $\text{Qdn}.\text{2}(\text{SO}^4\text{H}).12\text{aq.}$ Eq. Weight 488. Obtained by adding sulphuric acid to the neutral salt. It consists of an asbestos-like mass of fine acicular crystals. By drying at 212° they lose 19 per cent. of water (Winckler).

COMPARATIVE TABLE OF SOME DISTINGUISHING PROPERTIES OF QUINA, QUINIDINA, AND CINCHONINA.

	Quina.	Quinidina.	Cinchonina.
The anhydrous alkaloid is	Amorphous (the hydrate crystallizes with difficulty).	Crystalline (crystallizes from the alcoholic solution).	Crystalline (readily crystallizes from the alcoholic solution).
Taste	Very bitter	Bitter (less intensely so than quina).	Bitterish, unpleasant (somewhat analogous to sulphate of magnesia).
Optical properties { Fluorescence of a solution of the alkaloid { Rotatory polarization	Fluorescent	Fluorescent?	Not fluorescent.
	Left-handed	Left-handed	Right-handed.
Solubility of 1 part of alkaloid in	Cold water	In 250 parts	Almost insoluble.
	Boiling water	In 1858 parts	In 2500 parts.
	Cold rectified spirit	In 12 parts of cold spirit; the alkaloid is much more soluble in boiling spirit.	In 33 parts.
	Boiling rectified spirit		Insoluble.
A solution of the alkaloid (e. g. of the sulphate in water) treated first with chlorine-water, then with ammonia	Cold ether	In 60 parts.	
		Becomes emerald-green.	Remains unchanged, or yields a white precipitate.
Solubility of 1 part of the sulphate of the alkaloid in	Cold water	In 740 parts	In 54 parts.
	Boiling water	In 30 parts	In 64 parts [in 114 parts of anhydrous alcohol]
	Cold rectified spirit	In 60 parts	
	Boiling rectified spirit	[Much more soluble than in cold spirit.]	Very easily soluble.
	Cold ether	Slightly soluble	Almost insoluble
			Insoluble.

¹ Van Heiningen's formula, as corrected by the editors of the *Ann der Chemie* (Bd lxxxi. p. 364), is $2(\text{C}^{26}\text{H}^{22}\text{N}^2\text{O})_2.\text{SO}^4\text{H}.\frac{1}{2}6\text{aq.}$ This would indicate 12.6 per cent. of water; the quantity obtained by Van Heiningen being 12.81 per cent. But Winckler (*Pharm. Journ.* vol. vii. p. 531), found 17.5168 per cent. of water in the crystallized salt, and 5.7777 per cent. in the efflorescent salt. The formula in the text represents 17.56 per cent. of water. The formula for the salt dried at 212° is, according to Leers ($\text{C}^{26}\text{H}^{22}\text{N}^2\text{O})_2.\text{SO}^4\text{H}.$

² *Pharmaceutical Journal*, vol. xi. p. 394, 1852.

³ *Ibid.* vol. vii. p. 631, 1847.

⁴ Commercial sulphate of quinidina usually contains sulphate of quina, and in consequence its solution becomes green when successively treated with chlorine-water and ammonia.

4. ARICINA.

In 1829,¹ Pelletier and Coriol obtained from Arica bark (see *ante*, p. 652), an alkaloid to which they gave the name of *Aricine*. They describe it as being crystalline, and resembling in appearance cinchonia, from which it was distinguished by not being volatilizable; by its solubility in ether; by its sulphate not crystallizing from its aqueous solution, but forming a tremulous jelly,² which by desiccation acquired a horny appearance; by the alkaloid acquiring a green colour by the action of nitric acid; and lastly, by its weaker saturating power. In 1833, Pelletier³ stated that the gelatinizing property of the sulphate only belonged to the neutral solution, for he found that when there was an excess of acid the sulphate crystallized in flattened needles; and he farther observed that aricine contained one atom more oxygen than quina, its formula being $C^{20}H^{12}NO^3$.

These statements have not been confirmed by subsequent observers. Guibourt⁴ declares that the bark yielded him cinchonia and not aricine; and from his statement (already quoted at p. 654), it would appear that Pelletier himself subsequently doubted the peculiar nature of aricine. Winckler⁵ asserts that the green colouration by nitric acid depends on the presence of a minute portion of resin; but he admits the existence of a cinchona alkaloid, distinct from both quina and cinchonia, and which he calls *cusconin*; and declares it to be identical with Manzini's *cinchovatin* or *cinchovine*.⁶ Since the discovery of quinidine, however, the whole subject requires re-examination.

PARICINE.—This name (derived from *Para* and *aricine*) has been given, by Winckler,⁷ to a supposed distinct cinchona alkaloid obtained from Para bark. It closely resembles aricine, but differs from it by its greater solubility in ether, its uncrystallizability, and its greater equivalent weight. Nitric acid causes a precipitate in a solution of the sulphate of paricine. In this and some other properties paricine resembles bibirina (see *ante*, p. 409). Winckler⁸ at first considered it to be identical with Manzini's *cinchovatine* or *cinchovine*,⁹ but he subsequently discovered his error.

CHEMICAL CHARACTERISTICS.—The chief constituents of the cinchona barks for which tests or reagents are applied, are the cinchona alkaloids, and principally quina. But as the therapeutical value of the barks depends, in part, on their astringency, tests are also employed to detect the cincho-tannic acid. "There exists a law in Sweden," says Berzelius,¹⁰ "in virtue of which every cinchona bark imported into the country is tested by the infusion of galls, the persulphate of iron, a solution of gelatine, and emetic tartar; and it is proved, by an experience of more than sixteen years, that the most efficacious bark is that which precipitates the most strongly a solution of gelatine and emetic tartar; in other words, that which contains the most tannin." Moreover, as the bitterness of cinchona barks is not in all, if indeed it is in any cases exclusively dependent on the alkaloids, but usually depends in part (in some of the false cinchona barks it depends exclusively) on the presence of kinovic acid, Winckler¹¹ recommends the testing of barks to determine the amount of this acid which they contain. Lastly, the detection of kinic acid has been proposed by Dr. Stenhouse¹² as a means of discriminating the true cinchona barks from the false ones.

1. **Tests for the Cinchona Alkaloids.**—The tests for the cinchona alkaloids which deserve especial notice are the following:—

1. *Tannic acid* is a very delicate test of the cinchona alkaloids, which it precipitates from their solutions in the form of *tannates*. On this depends the value of *infusion* or *tincture* of *nutgalls*, employed as a test of the *goodness* of bark by Vauquelin,¹³ by Berzelius,¹⁴ and by O. Henry.¹⁵ Winckler regards this as the only test applicable for the discovery of the cinchona alkaloids.

2. *Chloride of platinum.*—Duflos's quinometrical method¹⁶ is founded on the property of the

¹ *Journ. de Pharmacie*, t. xv. p. 565, 1829.

² *Lavocholm* (Buchner's *Repertorium*, Bd. xxxii. S. 478, 1829; and Bd. xxxiii. S. 353, 1830), also obtained from Cincho bark a substance whose sulphate possessed a gelatinizing property; but he declares it to be neither alkaline nor crystallizable.

³ *Journ. de Pharmacie*, t. xix. p. 101, 1833.

⁴ *Buchner's Repertorium*, 2ter Reihe, Bd. xxv. p. 298, 1824.

⁵ *Ibid.* 2ter Reihe, Bd. xxxi. p. 249, 1843.

⁶ *Ibid.* 2ter Reihe, Bd. xli. p. 145, 1846.

⁷ *Traité de Chim.* v. 587, Paris, 1831.

⁸ *Handbuch für praktische Pharmacie*, Bd. xxv. S. 129, 1852.

⁹ *Annals of the Chemical Society*, vol. ii. p. 226, 1845.

¹⁰ *Traité de Chimie*, t. v. p. 587, Paris, 1831.

¹¹ *Pharm. Central-Blatt für 1831*, S. 537.

¹² *Ibid.* 2ter Reihe, Bd. xlii. p. 29, 1846.

¹³ *Chemical Gazette*, vol. i. p. 45, 1812.

¹⁴ *Ann. de Chimie*, lix. 113.

¹⁵ *Journ. de Pharm.* xx. 120, 1834.

cinchona alkaloids to form with [neutral] chloride of platinum double salts (*platinum-chlorides of the alkaloids*), which are insoluble in alcohol, and very difficultly soluble in cold water. One grain of these salts dried in the air contains about half a grain of the alkaloids.

3. *Production of Cincholine*.—Dr. Stenhouse¹ has proposed to detect the cinchona alkaloids in a bark by the following process: "Macerate the bark with dilute sulphuric acid, and precipitate with a slight excess of carbonate of soda or potash. Collect the dark coloured, very impure precipitate, and distil it with a great excess of caustic soda or potash; cincholin will distil over in oily drops if the bark has contained either of these vegetable alkaloids. Cincholin is easily recognizable by its peculiar taste and smell, and its strongly marked alkaline properties. It is nearly insoluble in water, unless first neutralized by an acid, when it readily dissolves; but it is immediately precipitated in oily drops on the addition of an alkali." This test only indicates that the bark contains at least one alkaloid, the nature of which must be determined by other means; for other alkaloids (as strychnia) yield cincholin when distilled with potash.

Oxalate of Ammonia and Sulphate of Soda (see *ante*, p. 646), have been used as tests of the alkaloid value of bark. They detect not the alkaloids, but lime; and it has been assumed (erroneously, as I believe) that in proportion to the quantity of lime in bark so is that of the alkaloids. But Puttfarcken's results, before referred to (see *ante*, p. 669), lead to an opposite conclusion.

2. Tests for Tannic Acid.—These are three in number:—

1. *A solution of gelatine*, which occasions in infusion of cinchona a whitish precipitate (*cincho-tannate of gelatine*).

2. *A solution of a sesquiferruginous salt* (as persulphate of iron or sesquichloride of iron), which produces a green colour or precipitate (*cincho-tannate of the sesquioxide of iron*).

Winckler² says that the precipitates caused by sesquichloride of iron and isinglass solution are those formed by the *oxidized tannin*; and he adds that the quantity of non-oxidized tannin, contained in the fluid, obtained by filtration from the separated magma, may be determined by *iodic acid*, which oxidizes the tannin, and causes the separation of a yellowish-brown pulverulent precipitate, with the evolution of the odour of iodine. The amount of the two precipitates enables us to determine the proportion of the oxidized and pure cincho-tannic acid.

3. *A solution of emetic tartar*, which causes a dirty white precipitate (*tannate of tetroxide of antimony*).

3. Tests for Kinovic Acid.—The best test for this acid is sulphate of copper.

In an infusion of a cinchona bark devoid of kinovic acid sulphate of copper produces no appreciable effect; but when this acid is present, a dark green colour is immediately produced, and very shortly a precipitate of kinovate of copper falls down, which, when collected and washed in a filter, has a bitter metallic taste. The amount of the precipitate is in proportion to the quantity of kinovic acid present.

4. *Tests for Kinic Acid*.—The readiest method of detecting this acid is that described by Dr. Stenhouse, and which consists in converting it into kinone (see *Kinic Acid*).

Winckler³ detects kinic acid by digesting the bark (previously exhausted by rectified spirit) in cold distilled water. Filter the infusion, and concentrate by evaporation. Then mix it with binoxide of manganese and moderately strong sulphuric acid, and submit the mixture to distillation. The slightest quantity of kinic acid may be detected by the production of kinine. The presence of this may be recognized by its odour; or, if this be doubtful, by the dark colour which the distilled liquor assumes on the addition of a few drops of a solution of ammonia.

DIFFERENTIAL DIAGNOSIS.—The differential diagnosis of the cinchona barks is effected by a consideration of the external or physical characters of the bark, by microscopical examinations, and by chemical means.

The external or physical characters of the more important of the genuine cinchona barks of commerce have been already described. Their examination may be greatly aided by coloured plates,⁴ but chiefly by comparison with well-authenticated specimens.⁵

The microscopical examination of the barks is calculated to be more useful in

¹ *Memoirs of the Chemical Society of London*, vol. ii. p. 227, 1845.

² *Jahrbuch für praktische Pharmacie*, Bd. xxv. S. 129, 1852.

³ *Ibid.* Bd. xxv. S. 136, 1852.

⁴ Coloured plates of the cinchona barks have been published by Bergen (*Versuch einer Monographie der China*, 1826), by Goebel (*Pharm. Waarenkunde*, 1827—29), and by Weddell (*Hist. Naturelle des quinquina*, 1849).

⁵ An excellent collection, partly formed by myself, and including the specimens exhibited by Messrs. Howards and Kent at the Great Exhibition in 1851, is contained in the museum of the Pharmaceutical Society, in Bloomsbury Square, London.—Pavon's collection of Peruvian barks, in the British Museum, is the largest original collection in England. It has been ably described by Mr. J. E. Howard (*Pharmaceutical Journal*, vols. xi. and xii. 1852).

comparing and distinguishing cinchona barks than is usually supposed (see *ante*, pp. 640, 641, 646, 651, and 654; Figs. 327—348).

The chemical diagnosis of the genuine and false cinchona barks has been attempted by E. F. Anthon.¹ His most important results are embodied in the following table:—

DIFFERENTIAL CHEMICAL DIAGNOSIS OF TRUE AND FALSE CINCHONA BARK, ACCORDING TO E. F. ANTHON.

Infusion of Bark with	NH ₃ , turbidness and precipitate.	KI, within $\frac{1}{4}$ of an hour turbidness.	Fe ² A ³ , within five or six minutes turbidness and precipitate.	FeO, SO ³ after 5 hours turbidness and precipitate.	1. Loxa.
				FeO, SO ³ green colour, without turbidness.	2. Huanuco.
	KI, after $\frac{1}{4}$ of an hour no change.	Fe ² U ³ , green colour without turbidness.		FeO, SO ³ after a few minutes' turbidness and precipitate.	3. Rubiginosa.
				FeO, SO ³ green colour, without turbidness.	4. Rubra.
	SO ³ , immediately turbidness and precipitate.	KI, immediately turbidness and precipitate.	FeO, SO ³ , after 4 hours green colour without turbidness.	BaO, NO ³ immediately turbidness and precipitate.	5. Cusco.
				BaO, NO ³ no change.	6. Regia.
NH ₃ , brownness without turbidness; or no change.	KI, for the first hour no change.	FeO, SO ³ , after 4 hours turbidness and precipitate.		NaO, SO ³ after a few minutes' turbidness.	7. Huamalies.
				NaO, SO ³ no change.	8. Flava fibrosa.
	SO ³ , no change	KI, immediately turbidness and precipitate.		NaO, SO ³ after $\frac{1}{4}$ of an hour turbidness and precipitate.	9. Brasiliensis.
				NaO, SO ³ no change.	10. California.
	SO ³ , no change	KI, for the first hour no change.		Gelatine, turbidness.	11. Nova.
				Gelatine, no change.	12. St. Lucia.
	SO ³ , no change	CuO, SO ³ , immediately turbidness and precipitate.		StCl, yellow flocculent precipitate.	13. Bicolorata.
				StCl, pale red flocculent precipitate.	14. Caribæa.
	SO ³ , no change	CuO, SO ³ , no change.		BaO, NO ³ turbidness and precipitate.	15. Flava dura.
				BaO, NO ³ no change.	16. Pseudo Loxa.

The infusion of bark used in these experiments was prepared by pouring 4 parts of boiling distilled water over one part of bark cut in very small pieces. After 12 hours digestion the liquid was filtered and the tests immediately applied. If the infusion be kept for some time before it is tested discordant results may be obtained.

The following were the tests employed:—

NH₃. Pure liquor ammoniæ, sp. gr. 0.990.

KI One part of iodide of potassium dissolved in 6 parts of water.

SO₃. Pure diluted sulphuric acid, sp. gr. 1.090.

Fe²U³. One part of pure sublimed chloride of iron dissolved in 8 parts of water.

FeO, SO₃. One part of newly made sulphate of the protoxide of iron dissolved in 6 parts of water.

CuO, SO₃. One part of pure sulphate of copper dissolved in 12 parts of water.

BaO, NO₃. A saturated aqueous solution of nitrate of baryta.

NaO, SO₃. One part of pure sulphate of soda dissolved in 6 parts of water.

Gelatine. One part of gelatine (*weisser Leim*) dissolved in 12 parts of water.

StCl One part of newly made muriate of the protoxide of tin dissolved in 8 parts of water.

QUANTITATIVE DETERMINATION OF THE CINCHONA ALKALOIDS. Quinometry.

—Various alkalometrical processes, applicable to the cinchona barks, have been recommended. They are essentially of two kinds; some consist in the use of certain reagents or tests already described, others are processes for the extraction of the alkaloids, which are obtained either in the free state or as salts (usually as sulphates).

The *Edinburgh Pharmacopæia* gives the following directions for ascertaining the good quality of yellow bark:—

"A filtered decoction of 100 grains in two fluidounces of distilled water gives, with a fluid-

¹ Buchner's *Repertorium*, 2te Reihe, Bd. iv. p. 43, 1835; and Bd. vi. p. 29, 1836.

ounce of concentrated solution of carbonate of soda, a precipitate, which, when heated in the fluid, becomes a fused mass, weighing when cold 2 grains or more, and easily soluble in solution of oxalic acid." In this process, the native salts of the alkaloids extracted by the boiling water are decomposed by carbonate of soda. By heat the alkaloids fuse.

This process, however, is quite insufficient for the purposes of commerce.

In commerce, the value of a cinchona bark mainly depends on the quantity of crystallizable sulphate of quina which it is capable of yielding; and it is not, therefore, sufficient to determine the amount of quina which it yields, because the whole of this may not be convertible into crystallizable sulphate.

Some manufacturers subject their barks to the operation, hereafter to be described, for the manufacture of the crystallized sulphate of quina. The quantity operated on should never be less than a pound of bark; and even then the product is always smaller (to the extent of at least from $\frac{1}{3}$ to $\frac{1}{4}$) than can be obtained in operations on a large scale, where the loss is proportionately smaller.

*Wöhler's cinchona bark test*¹ is thus applied: Take half an ounce of the powdered bark, a sufficient quantity of water, and a scruple of hydrochloric acid. Boil, filter the decoction, and wash the residue with water. Evaporate the decoction to dryness, redissolve the extract in water acidulated with a few drops of hydrochloric acid; the cinchona red remains undissolved. Precipitate the alkaloids from the solution by ammonia, and collect, dry, and weigh the precipitate. The alkaloids are separated from each other by ether, which dissolves quina and quinidina, but leaves the cinchona.

*Buchner's cinchona bark test*² is thus employed: Take one ounce of cinchona bark in powder, twelve ounces of water, and dilute sulphuric acid half a scruple. Boil for half an hour. Wash the residual powder with four ounces of hot water. Filter the decoction and immediately add to it ammonia or carbonate of soda. Wash the precipitate with a little cold water, press it between folds of blotting-paper, dry it in a water-bath, and then weigh it. The whole operation may be performed within one and a half or two hours. (The alkaloids comprising the precipitate may be separated from each other by ether.)

The following is *Raboulin's cinchona bark test*³ as applied for yellow bark: Take five drachms of bark powdered and passed through a fine horse hair sieve; exhaust it with water acidulated with hydrochloric acid (2 parts by weight of acid to 100 parts of water) in a displacement apparatus. The percolation of the liquid is to be stopped when it passes through colourless and insipid. We thus obtain about five or six ounces of liquid, to which about a drachm and a half of caustic potash and two and a half drachms of chloroform are to be added. Agitate them for a short time, and then set them aside. A whitish, very dense deposit, composed of quina, cinchonia, and chloroform, is formed. Sometimes the separation is completely effected in an instant, leaving a red transparent supernatant liquid which may be immediately decanted, and the chloroformic solution washed, collected in a small capsule, and allowed to evaporate spontaneously, leaving the alkaloids in a pure state.

Winckler's cinchona bark test is as follows: Exhaust the powdered bark by rectified spirit, sp. gr. 0.840. Decolorize the tincture by a mixture of equal parts of slacked lime and animal charcoal, and then distil off the greater part of the spirit in a water-bath. The residue contains the alkaloids in combination with kinovic acid (when this acid is a constituent of the bark), and a peculiar fatty matter. Frequently, there is also present a small quantity of oxidized tannin, which is mechanically mixed with the other ingredients. To purify the alkaloids dissolve them in water acidulated with sulphuric acid, and filter the solution; by this means we get rid of the kinovic acid and fatty matter. Add to the filtered liquor a slight excess of ammonia, and evaporate the mixture to dryness; and then extract the sulphate of ammonia by means of a little cold water. The residual alkaloids are afterwards to be dried and weighed; as any farther purification of them is attended with too great a loss to be practised. The quina and cinchonia are to be separated from each other by means of ether.

The separation of the cinchona-alkaloids from each other is usually effected by means of ether, which dissolves quina and quinidina, but leaves cinchona. Quinidina is separated from quina by its crystallization from its ethereal solution; quina not being crystallizable.

Pelletier and Cavenot⁴ separated quina and cinchonia by means of boiling alcohol; as the solution cools the cinchonia crystallizes, leaving the quina in solution. Winckler⁵ employed rectified spirit to separate quinidina from quina; the former alkaloid crystallizes from the alcoholic solution.

¹ *Pharmaceutical Journal*, vol. xi. p. 164, 1851.

² *Ibid.*

³ *Journ. de Pharmacie et de Chimie*, 3me ser. t. xix. p. 11, 1851; and *Pharmaceutical Journal*, vol. x p. 470, 1851.

⁴ *Journ. de Pharmacie*, t. vii. p. 305.

⁵ *Chemical Gazette*, vol. vi. p. 164, 1845.

The different solubilities of the sulphates of the three alkaloids in water may also be employed to separate them; the sulphate of quina is the first to deposit as the solution cools, leaving the sulphate of cinchona in solution. Sulphate of quinidina has an intermediate solubility.

TABLE SHOWING THE QUANTITY OF ALKALOIDS OBTAINED FROM CINCHONA BARKS, ACCORDING TO RECENT AUTHORITIES.

100 parts of Bark.	Quina.	Quinidine.	Cinchona.	Total Alkaloids.	Authority.	Observations.
CALISAYA OR YELLOW BARK.						
Best sort	38.0	[+]	[+]	?	Riegel.	According to Pelouze, 1000 parts of Calisaya bark yield from 30 to 40 parts of sulphate of quina. An ounce of commercial sulphate of quina is obtained from 1½ lbs. to 2¼ lbs. avoird. of bark.
Medium sort	25.0	[+]	[+]	?	Riegel.	
Var. β Josephina	32.9	[+]	[+]	?	Riegel.	
CARABAYA BARK.						
Commercial (see ante, p. 652).	+	+	+	30 to 40	J. E. Howard.	Used in the fabrication of sulphate of quina.
RED BARK.						
Best sort	26.5	[+]	15.1	41.6	Riegel.	According to Pelouze, 1000 parts of bright red bark yield from 15 to 16 parts of sulphate of quina, and from 8 to 9 parts of sulphate of cinchona. The produce of the paler sort is less.
Broad flat pieces	[+]	[+]	[+]	39.5	Riegel.	
LOXA BARK.						
Original old sort in bundles . .	7.14	5.14	0.10	12.68	J. E. Howard.	According to Pelouze, 1000 parts of gray Loxa bark yield from 10 to 12 parts of sulphate of cinchona.
H. O. Crown, 1850	0	5.7	0.6	6.3	J. E. Howard.	
H. O. Crown, 1851	0	10.5	0.8	11.3	J. E. Howard.	
Ashy Crown	5.0		9.14	14.14	J. E. Howard.	
Ashy Crown mixed with corky crown	4.0		2.85	6.85	J. E. Howard.	
The so-called finest crown . .	5.2	..	4.2	9.4	Riegel.	
GRAY OR HUAMUCO BARK.						
Fine gray (<i>Cinchona nitida</i> ?) . .	5.71	1.42	14.0	21.13	J. E. Howard.	Fine gray and inferior gray are frequently imported intermixed. Pelouze states that 1000 parts of gray Lima bark yield 11 to 12 parts of sulphate of cinchona.
Interior or coarse gray (<i>Cinchona micrantha</i> ?)	2.43	2.80	12.5	17.73	J. E. Howard.	
Heavy medium quills . . . . .	..	..	24.0	..	Riegel.
Thick quills . . . . .	..	..	18.7	..	Riegel.
ASH-BARK.						
Flat pieces	0	12	16	28	J. E. Howard.	
Mean-looking specimen	0	6.1	8.6	14.7	J. E. Howard.	
HUAMALIES OR RUSTY BARK.						
White-coated sort	0	2.57	7.4	9.97	J. E. Howard.	It is tolerably obvious that very different barks have been included under the designation of Huamalties bark.
Thick quills and arched flat pieces	3	..	8.6	11.16	Winckler.	
Fine and medium quills and flat pieces . . . . .	..	..	14.6	..	Riegel.
Thick warty quills and flat pieces . . . . .	..	..	9.3	..	Riegel.
PITAYA-CONDAMINEA BARK.						
Of English Commerce	+	+	+	..	J. E. Howard.	Used in the fabrication of sulphate of quina. 1000 parts, according to Guibourt, yield 11.52 of sulphate of quina.
Quinquina Pitaya . . . . .	..	+	23	..	Guibourt.
CARTHAGENA BARKS.						
a Hard sort (<i>C. cordifolia</i>). . .	10.4	..	13.5	23.9	Riegel.	The fibrous Carthagena or Coquetta bark is used by sulphate of quina manufacturers, but the produce is exceedingly variable. From the three samples analyzed by Mr. Hindsley, he obtained respectively 10.3, 4.6, and 8.2 parts of sulphate of quina from 1000 parts of bark. An ounce of sulphate of quina is obtained from 4 to 6 lbs. of bark.
Cinna flava dura						
2 Fibrous sort (<i>C. lancifolia</i>). .	10.4	..	10.4	20.8	Riegel.	
Cinna flava fibrosa						
Coquetta bark	+	1.5	4.4	..	Hindsley.	
Trimmed <i>lancifolia</i> bark	+	2.5	3.5	..	Hindsley.	
Uncoated quill	+	2.3	12.6	..	Hindsley.	

PHYSIOLOGICAL EFFECTS.—Before I proceed to describe the effects of cinchona barks it appears to me desirable to notice the separate effects of those principles on whose combined operation the activity of the bark depends.

I. *Effects of the Active Principles of Cinchona Bark.*

The essential or tonic and antiperiodic or specific effects of the bark reside in the cinchona alkaloids; but these are aided by some of the other constituents. The astringent and aromatic qualities of the bark reside in other principles.

1. *Effects of Cincho-tannic Acid.*—Like other varieties of tannic acid, this acid possesses astringent qualities, and promotes the tonic operation of the alkaloids. It is remarkable, in a chemical point of view, for the facility with which it suffers oxidation; and it is probable, therefore, that in its passage through the system it more readily undergoes oxidation than most other forms of tannic acid (see *ante*, p. 325).

2. *Effects of Kinovic Acid.*—As this is a bitter principle, it might be expected to possess tonic and possibly febrifuge properties. Dr. Weil,¹ however, declares that it is not a febrifuge; for it failed to relieve a case of tertian fever, which was afterwards readily cured by sulphate of quina. This is all that is known of its physiological and therapeutical powers.

3. *Effects of Kinic Acid.*—Nothing positive is known of the effects of kinic acid or the kinates. Kinate of lime, which Desechamps erroneously fancied to be the active principle of cinchona bark, is probably inert. It has neither bitterness nor stypticity.

4. *Effects of Cinchona-red or Red Cinchonina.*—May perhaps slightly contribute to the astringent and tonic effects of the barks.

5. *Effects of the Volatile Oil and Resin.*—The aromatic flavour depends on these principles.

6. *Effects of the Cinchona Alkaloids.*—Quina, cinchonina, and quinidina are the only alkaloids with whose operation we are acquainted.

1. **Effects of Quina.** *On Vegetables.*—According to Goepfert, the leaves of plants plunged in a solution of sulphate of quina (gr. ss of the salt to 3ss of water) presented evidences of contraction in six or eight hours.²

3. *On Animals generally.*—As soon as Pelletier had discovered the alkaloids in bark, he sent some of them to Magendie for trial, who ascertained that neither in the pure nor saline state were they poisonous; and he found that ten grains of the sulphate or acetate of these bases might be injected into the veins of a dog without any ill effect.³ Hartl⁴ found that three grains of quina applied to a wound in a rabbit occasioned no ill effects.

Later observations, however, have shown that in certain doses sulphate of quinine proves fatal to animals. Melier⁵ found that it occasioned stupor, staggering, or sudden falling down, dilatations of the pupil, coma, convulsions, and in all cases increased frequency of pulse. The *post-mortem* appearances were congestion of the lungs and deficient coagulability of the blood.

γ. *On Man.*—In small doses quina occasions an intensely bitter taste, promotes the appetite, and assists digestion. It possesses in a pre-eminent degree the properties of a pure or simple bitter (see vol. i. p. 244).

In large doses (as ten to twenty or more grains), disulphate of quina has produced three classes of effects:—

1. *Gastro-enteric irritation*, marked by pain and heat in the gastric region, nausea, gripings, and purging. Occasionally, pyalism has been observed. Constipation sometimes follows its use.

¹ Buchner's *Repertorium*, 2te Reihe, Bd. iii. p. 396, 1835.

² *Journ. de Pharm.* vii. 135.

³ *Exper. et obs.* sur les propriétés toxiques du sulfate de quinine (Mém. de l'Acad. Royale de Med. t. x.

p. 722, 1843).

⁴ De Candolle. *Phys. Vég.* 1349.

⁵ *Wirk. d. Arzneim. u. Gifte*, Bd. ii. S. 123.

2. *Excitement of the vascular system*, manifested by increased frequency and fulness of pulse and augmented respiration. Furred tongue, and other symptoms of a febrile state, are also observed.

3. *Disorder of the cerebro-spinal functions*, indicated by headache, giddiness, contracted, in some cases dilated, pupils, disorder of the external senses, agitation, difficulty of performing various voluntary acts (as writing), somnolency, in some cases delirium, in others stupor.

A remarkable case is mentioned by Trousseau and Pidoux.¹ A soldier took forty-eight grains of sulphate of quina for the cure of an asthma [spasmodic], which returned daily at a certain hour. Four hours after taking it he experienced buzzing in the ears, diminished sensibility, giddiness, and violent vomitings. Seven hours after taking the quina he was blind and deaf, delirious, incapable of walking on account of the giddiness, and vomited bile copiously. In fact, he was in a state of intoxication. These effects subsided in the course of the night.

On man, as in the lower animals, sulphate of quina has produced fatal effects. Recamier,² at the Hôtel Dieu, prescribed for a patient affected with acute rheumatism three grammes [=46 grs. Troy] of the sulphate in twelve powders, one to be taken every hour. The next day the quantity was increased to five grammes [=77 grs. Troy] similarly divided, to be taken every hour as before. When the patient had taken three and a half grammes [=53 grs. Troy] he was suddenly seized with violent agitation, followed by furious delirium and death in a few hours.

Dangerous consequences have been reported by other writers.³ But in many cases no ill effects have resulted from the use of large doses. Thus, Bally has given 110 grains daily without any inconvenience. From these and other cases sulphate of quina has been denominated a *narcotic*. In some instances it has appeared to act as a *stimulant*, in others as a *sedative*.⁴

I have already (see *ante*, p. 263) mentioned Piorry's observation that quina diminishes the volume of the spleen, and in this way cures ague.

Sulphate of quina, when taken into the stomach, becomes absorbed into the blood, and is eliminated by the urine, the sweat, and the milk.⁵ Mérat even states that after the use of it he has observed in his own person that the expectorated mucus smells of cinchona!

II. *Effects of Quinidina*.—But few observations have hitherto been made on the effects of this alkaloid. From the similarity of its chemical properties to those of quina it has been inferred, and, as I believe, correctly, that it resembles the latter alkaloid in its medicinal qualities. Bauduin⁶ declares it to be as effective a febrifuge as quina. I have for some months past used at the London Hospital the sulphate of quinidina as a substitute for sulphate of quina, and have found it equally serviceable both as a tonic and febrifuge. Several cases of ague in the Hospital have got entirely well under its use. I have administered it in varying doses not exceeding ten grains.

III. *Effects of Cinchonia*.—If we take into consideration the similarity of chemical properties of cinchonia and quina, we are led to suspect analogy of physiological effects. When they were in the first instance submitted to examination, cinchona and its salts were thought, principally on the evidence of Chomel, to be much inferior in activity to quina and its salts. But the subsequent observations of Dufour, Petros, Pottier, Bally, Nieuwenhuiss, Mariani, Bleyne, and others, have appeared to prove that the sulphates of these alkaloids may be substituted for each other.⁷ Nay, Bally gives the preference to the sulphate of cinchonia, on the ground that it is less irritating than the sulphate of quina. That cinchonia is as active as quina might have been anticipated, *à priori*, when we recollect that those barks in which cinchonia is the predominant principle, were the first which were celebrated as therapeutic agents.

¹ *Traité de Thérap.* ii. 217.

² *Ibid.* pp. 172 and 173.

³ Bouehardat, *Annuaire de Thérap.* pour 1843, p. 170.

⁴ Dunglison, *New Remedies*, 6th edit. p. 68, 1851.

⁵ Landreter, *Buchner's Repert.* 2te Reihe, Bd. v. p. 231; also Quévenne, Piorry, Lavallée, Melier, &c. quoted by Mérat (*Suppl. au Dict. de Mat. Méd.* p. 602, 1846).

⁶ Quoted by Van Heijningen, in the *Pharmaceutical Journal*, vol. ix. p. 327, 1850.

⁷ *Dict. de Mat. Méd.* t. v. p. 596.

As cinchona and its salts are less bitter than quina and its salts, we might expect that the former would possess somewhat less medicinal activity than the latter; and this inference is probably correct. Moreover, as cinchonia and its salts have a more nauseous flavour, and are more allied to that of sulphate of magnesia, it might naturally be anticipated that large doses of sulphate of cinchonia would be more apt to create nausea and vomiting than like doses of sulphate of quina; and I have been informed by some medical friends, that this is in reality the case. I must confess, however, that I have been unable to verify it. I have extensively used in hospital practice, sulphate of cinchonia, in doses not exceeding ten grains, and have not met with the nausea and vomiting I expected to have met with. In a case of ague, I ordered the patient (a young man) to take ten-grain doses of the sulphates of quina, quinidina, and cinchonia on separate successive days, every two hours before dinner; that is, the sulphate of quina on one day, the sulphate of quinidina on the second, and the sulphate of cinchonia on the third day. The case was very carefully watched by one of my clinical clerks, but no difference of effect was discernible. No sickness or vomiting took place. I have found the sulphate of cinchonia valuable both as a tonic and a febrifuge, or antiperiodic.

Comparison of the Cinchona Alkaloids with their Salts.—Some of the salts of the cinchona alkaloids being more soluble than their bases, it has been inferred that they are, consequently, more active. But it has been asserted by Nieuwenhuiss, Mariani, Bleyne, and others, that the bases are equally active, and may be substituted for the salts with advantage. Acid drinks should be given to favour their solution in the stomach. Quina, in the crude or impure state, has been employed with success by Trousseau.¹ Its advantages over the disulphate are, that it is less apt to purge; it may be exhibited in a smaller dose, and it loses but little bitterness. This last property facilitates the use of it, especially in children.

Comparison of the salts of the Cinchona Alkaloids with each other.—I have already described the effects of the sulphate of quina. The bisulphate of quina is formed when we dissolve the sulphate in water, acidulated with sulphuric acid; it is somewhat more irritant than the last-mentioned salt. The phosphate of quina is said to be not so apt to disturb the stomach, or to excite the vascular system, as the sulphate. Hence, it is better adapted for cases accompanied with gastric irritation and febrile disorder. The ferrocyanate of quina has been recommended, in preference to the sulphate, in intermittent fevers, accompanied with inflammatory symptoms. The tannate of quina has been declared, by Dr. Rolander, of Stockholm, to be the most powerful of the quina salts. The tannic acid, though not the peculiar febrifuge constituent of cinchona bark, yet contributes to its tonic powers, and thereby promotes the activity of the alkaloids. This statement is supported by the already referred-to remark of Berzelius, that the most active cinchonas are those which contain the largest quantity of tannin. Recent observations have not, however, confirmed Rolander's statement. The nitrate, hydrochlorate, acetate, and citrate of quina, have been employed in medicine; but I am not acquainted with any remarkable advantages they possess over the sulphate. The kininate of quina, as being one of the native salts of alkaloid, deserves farther examination. The arsenite of quina might, perhaps, be found available in some obstinate intermittents, and well deserves farther examination. The valerianate of quina has been already noticed (see *ante*, p. 615). The sulphate of quinidina is the only salt of quinidina whose effects have been examined. The salts of cinchonia, except the disulphate, have been imperfectly examined.²

¹ Soubeiran, *Traité de Pharm.* i. 604.

² For farther details respecting the effects of the salts of quina, consult Mérat and De Lens, *Dict. de Mat. Méd.* t. v. 597, and Mérat, *Suppl. au Dict. de Mat. Méd.* p. 690, 1846; Dierbach, *Nouv. Encycl. de Mat. Méd.* Bd. i. S. 237, 1837, and Bd. ii. S. 366, 2^e Aufl.; and Dunglison, *New Remedies*, 6th edit. 151.

II. *Effects of the Cinchona Barks.*

The experiments of Dr. Adair Crawford¹ on the effects of tonics in promoting the cohesion of the animal tissues, have been already (see *ante*, p. 243) referred to. He found that a kitten's intestines, which had been immersed in a thick mixture of cinchona bark and water, required a greater weight to break them than those immersed in water merely, in the ratio of 25.5 to 20.7. He found, moreover, that the same effect was produced on the bloodvessels and nerves; but an opposite effect on the skin, the cohesion of which it diminished in the ratio of 24.5 to 7.9. Hence, he inferred that cinchona bark strengthened the alimentary canal, bloodvessels, and nerves, but had a debilitating or relaxing effect on the skin.² The error pervading these inferences has been already pointed out. Admitting that the dead animal tissues are invariably affected by cinchona in the way Dr. Crawford states, the conclusion that living tissues would be influenced in the same way is not supported by facts. Cold water relaxes dead, but corrugates living, animal tissues.

a. *On Vegetables*.—Leaves of plants immersed in an infusion of pale bark were dried, but not contracted, in twenty-four hours.³

β. *On Animals generally*.—Dr. Freind⁴ states that an ounce and a half of a strong decoction of bark, injected into the jugular vein of a dog, caused, in fifteen minutes, strong palpitations of the heart, and frequent spasms. Half an ounce more being injected, brought on tetanus and death. The blood was found after death liquid, the lungs red and turgid; the right ventricle was distended with blood, the left contained scarcely any. Rauschenbusch⁵ has also made experiments with cinchona bark. In animals to whom he had given it for some days, he found the stomach and alimentary canal contracted, and the coats thickened, but no traces of inflammation. The heart was firmer, the lungs covered with red spots, the liver yellowish, the bile watery and greenish. When the blood was exposed to the air, it remained dark-coloured for a longer time than usual, was less coagulable, and the serum separated more slowly; it appeared like that drawn in inflammatory cases. The pulse was stronger and fuller, the animal heat increased, and, when the bark had been used for a long period, the muscles were pale, and their energy enfeebled. Some experiments on the effect of cinchona on the blood-disks of frogs were made by Leeuwenhoek,⁶ who found that the infusion of bark divided some of the disks, and coagulated others.

γ. *On Man*.—The *topical effects* are astringent and slightly irritant. The astringency depends on tannic acid [and red cinchonic?]: hence those barks whose infusions are most powerfully affected by gelatine and the sesquiferruginous salts, enjoy the greatest astringent power. The *constitutional effects* are principally manifested by the disordered conditions of the vascular and cerebro-spinal systems. In some conditions of system cinchona operates as an *irritant* or *stimulant*; in others as a *stomachic*, *tonic*, and *corroborant*.

If a man in a state of perfect health takes a small or moderate dose of bark, no obvious effects are produced, or perhaps a little thirst, with some slight disorder of stomach; or a temporary excitement of appetite may be brought on. If the dose be increased, the alimentary canal becomes disordered (indicated by the nausea, vomiting, loss of appetite, thirst, and constipation, or even purging); a febrile state of the system is set up (manifested by the excitement of the vascular system, and dry tongue); and the cerebro-spinal system becomes disordered, as is shown by the throbbing headache and giddiness. The disturbance of the functions of the stomach is produced not only when the bark is given in the more nauseating form of pow-

¹ *Experimental Inquiry into the Effects of Tonics*, 1816.

² It is obvious that the tannic acid contained in cinchona bark would exercise a local chemical influence on the tissue, combining with both the albuminous and gelatinous tissues.

³ De Candellet, *Phys. Vég.* 1349.

⁴ Quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. ii. 132.

⁵ *Emmenol.* c. xiv.

⁶ *Contin. ad Epist.* p. 119.

der, but also in the form of infusion, or decoction, or tincture. These symptoms indicate a stimulant operation, which is still more manifest when the bark is given to a person suffering with gastro-enteric irritation, accompanied with fever. All the morbid phenomena are exasperated, the febrile disorder is increased, and symptoms of gastritis come on. None of the effects now enumerated include those to which the term *tonic* is properly applicable. These are to be sought for in patients suffering from debility, without symptoms of local irritation. In such, we find cinchona improves the appetite, promotes the digestive functions, and increases the strength of the pulse. The muscular system acquires more power, and the individual is capable of making greater exertion, both mental and bodily, than before; the tissues acquire more firmness to the touch, and lose their previous flabbiness; moreover, it has been asserted (and with great probability of truth) that the quality of the blood improves.

The real *stomachic*, *tonic*, and *corroborative* effects of cinchona, as indeed of other agents of the same class, are then only observed in certain morbid conditions.

"The general operation of cinchona bark," observes Sundelin,¹ "consists in the *increase and exaltation of the tone of the irritable fibres and of the fibres of the vessels* (hence, by its use the pulse becomes fuller, stronger, and regular, and the muscular power increased); also in the *general augmentation of the cohesion of the organic mass* (hence, it counteracts a tendency to liquefaction [*Verflüssigung*] and disintegration [*Entmischung*], diminishes profuse secretions, which proceed from atony of the extremities of the vessels and of the seerning surfaces and organs, and improves generally the crasis); and lastly, in the *augmentation of the vital energy of the sensible system*. (By the last-mentioned property it restores sensibility, when defective or abnormally increased, and the property of reaction of the nervous system to their normal state, and augments the influence of this system on the muscular fibre and on the reproductive system.") As these effects are not produced until the active constituents of the bark have been absorbed, they take place gradually, and by the long-continued use of this agent.

The power possessed by cinchona, of suspending or completely stopping periodical diseases, deserves to be noticed here, though it will have to be again referred to hereafter. It is doubtless in some way related to the before-mentioned effects; but the connection is, as yet, mysterious and incomprehensible.

Comparison of the Cinchona Barks with each other.—Those barks are the most active which contain the largest proportion of the cinchona alkaloids, especially of quina. In this point of view *yellow* or *Calisaya* bark stands pre-eminent; and Dr. Relph's² assertion of its superiority to both the red and the pale barks is fully borne out by modern observations. *Red bark* is also a very valuable sort. The experiments and observations of Saunders,³ Rigby,⁴ Kentish,⁵ Irving,⁶ and Skeete,⁷ seem to have established its superiority to the pale or quilled kind. But in adopting this statement, we ought, if possible, to ascertain what kind of pale bark was used in making the above observations; and also to determine whether the red bark referred to be identical with that now in commerce. Mr. J. E. Howard (see *ante*, p. 659) has shown that the *original* or *old Loxa bark*, the sort, probably, which was originally employed under the name of pale or Crown bark, is as rich in cinchona alkaloids as many specimens of *Calisaya* bark.

The *H. O. Crown bark* and *ashy Crown bark* are, especially the last-mentioned bark, greatly inferior to the old *Loxa bark*; yet they are the barks usually found in the shops under the name of *pale* or *quilled bark*. *Fine gray bark* is a bark of excellent quality. *Pitaya-Condaminea bark*, is but little known in commerce; but it is a bark rich in cinchona alkaloids.

¹ *Handbuch d. speciellen Heilmittellehre*. Bd. ii. S. 307, 3tte Aufl. 1833.

² *Inquiry into the Medical Efficacy of Yellow Bark*, 1794.

³ *Observations on the superior Efficacy of Red Peruvian Bark*, 1782.

⁴ *Essay on the Use of Red Peruvian Bark*, 1783.

⁵ *Experiments and Observations on a New Species of Bark*, 1784.

⁶ *Experiments on Red and Quilled Peruvian Bark*, 1785.

⁷ *Experiments and Observations on Quilled and Peruvian Bark*, 1786.

Comparison of the Effects of the Cinchona Barks with their Alkaloids.—It has been asserted that the cinchona alkaloids possess all the medicinal properties of the barks, and may be substituted for them on every occasion; but I cannot subscribe to either of these statements; for, in the first place, the alkaloids are deficient in the aromatic quality possessed by the barks, and which assists them to sit easily on the stomach; and it is to this circumstance that I am disposed to refer a fact which I have often observed, that sulphate of quina will sometimes irritate the stomach, occasion nausea and pain, and give rise to febrile symptoms, while the infusion of bark is retained without the least uneasiness. Moreover, we must not overlook the tannic acid, which confers on bark an astringent property. So, that while we admit that the essential tonic operation of the barks depends on the alkaloids which they contain, yet the latter are not always equally efficacious. In some cases, however, they are of great advantage, since they enable us to obtain, in a small volume, the tonic operation of a large quantity of bark.

USES.—From the preceding account of the physiological effects of cinchona, some of the indications and contra-indications for its use may be readily inferred. Thus its topical employment is obviously indicated in cases of local relaxation, with or without excessive secretion; also in poisoning by those agents whose compounds with tannic acid are difficultly soluble, and, therefore, not readily absorbed. But as a topical remedy, or astringent, cinchona is greatly inferior to many other agents which contain a much larger quantity of tannic acid. The contra-indications for the local use of cinchona, are, states of irritation (nervous or vascular), and of inflammation. In these conditions it aggravates the morbid symptoms.

The indications for its use, as a general or constitutional remedy, are, debility with atony and laxity of the solids, and profuse discharges from the secreting organs. I have observed that it proves less successful, and often quite fails, when the complexion is chlorotic or anæmic; in such cases chalybeates often succeed where cinchona is useless or injurious. As contra-indications for its employment, may be enumerated acute inflammation, inflammatory fever, plethora, active hemorrhages, inflammatory dropsies, &c. To these may be added, an extremely debilitated condition of the digestive and assimilative organs. Thus, patients recovering from protracted fever are at first unable to support the use of bark, which acts as an irritant to the stomach, and causes an increase of the febrile symptoms. In such cases I have found infusion of calumba a good preparative for cinchona.

Hitherto, I have referred to those indications only which have an obvious relation to the known physiological effects of cinchona. But the diseases in which this remedy manifests the greatest therapeutic power, are those which assume an intermittent or periodical type. Now, in such, the *methodus medendi* is quite inexplicable; and, therefore, the remedy has been called a *specific*, an *antiperiodic*, and a *febrifuge*. But the more intimately we become acquainted with the pathology of disease, and the operation of medicines, the less evidence have we of the specific influence of particular medicines over particular maladies. Some diseases, however, are exceedingly obscure; their seat or nature, and the condition of system under which they occur, or the cause of their occurrence, being little known. There are also many medicines, the precise action of which is imperfectly understood, but which evidently exercise a most important, though to us quite inexplicable, influence over the system. Now, it sometimes happens that imperfectly known diseases are most remarkably influenced by remedies, the agency of which we cannot comprehend; in other words, we can trace no known relation between the physiological effects of the remedy and its therapeutical influence. This incomprehensible relationship exists between arsenic and lepra; between the cinchona bark and ague. But though this connection is to us mysterious (for I do not admit the various hypotheses which have been formed to account for it), we are not to conclude that it is necessarily more intimate than that which exists in ordinary cases.

1. *In periodical or intermittent diseases.*—The system is subject to several diseases, which assume a *periodical* form; that is, they disappear and return at regular

intervals. When the patient appears to be quite well during the interval (*i. e.* when the intermission is perfect and regular) the disease is called an *intermittent*; whereas it is called *remittent* when the second paroxysm makes its appearance before the first has wholly subsided (*i. e.* when the disease presents exacerbations and remissions, but not intermissions). The pathology of these affections is involved in great obscurity, and the cause or causes of their periodicity are completely unknown. Various circumstances, however, induce us to regard intermittent maladies as morbid affections of the nervous system; for the phenomena of periodicity, both healthy and morbid, seem to be essentially nervous.¹ One of the most curious circumstances connected with the history of these diseases is the facility with which they are sometimes cured. It is well known that sudden and powerful impressions, both mental and corporeal (as those caused by terror, alcohol, opium, cinchona, arsenious acid, &c.), made during the intermission, will sometimes prevent the return of the succeeding paroxysm; and occasionally from that time all morbid phenomena disappear. In remittent diseases, on the other hand, the same impressions are much less frequently successful, and sometimes, instead of palliating, exasperate the symptoms. The agents which are capable, under certain circumstances, of making these curative impressions, are apparently so dissimilar in their nature and physiological action, that we can trace in their *methodus medendi* scarcely anything in common, save that of making a powerful impression on the nervous system. Of these *anti-periodic* agents, cinchona and arsenious acids stands pre-eminent for their greater frequency of success, and, therefore, are those usually resorted to. I have already (see p. 635) made some remarks on their relative therapeutical value. They differ in two particulars; first, cinchona may be given, as an antiperiodic, in any quantity which the stomach can bear; whereas, arsenious acid must be exhibited in cautiously-regulated doses; secondly, there are two modes of attempting the cure of an intermittent by cinchona; one is, to put an immediate stop to the disease by the use of very large doses of the remedy given a few hours prior to the recurrence of the paroxysm—the other is, to distinguish the disease gradually by the exhibition of moderate doses at short intervals during the whole period of the intermission, so that the violence of every succeeding paroxysm is somewhat less than that of the preceding one; but in the case of arsenious acid, the latter method is alone safe, and, therefore, to be adopted.

It has been asserted that cinchona is admissible in the interval only of an intermittent fever; and that, if it be exhibited during the paroxysm, it has a tendency to prevent the subsidence of the latter. But this statement is much overcharged. Morton² and others have given it in almost every stage without injury. Dr. Heberden³ observes, “the only harm which I believe would follow from taking the bark, even in the middle of the fit is, that it might occasion a sickness, and might harass the patient by being vomited up, and might set him against it.” It is, however, more efficacious during the interval, though it may not be absolutely hurtful in the paroxysm. Dr. Cullen⁴ was strongly of opinion that the nearer the exhibition of the cinchona is to the time of accession, the more certainly effectual will it be. I have already stated (vol. i. p. 635) that arsenious acid may be given with good effect during the whole period (paroxysm and intermission) of the disease.

A very necessary condition to its perfect success is that it sit well on the stomach; for if it occasion vomiting or purging, it is much less likely to act beneficially. Hence an emetic and a purgative are recommended to precede its employment. The use of these is more especially necessary if the disease be recent. For an adult, about fifteen grains of ipecacuanha, with a grain of tartarized antimony, may be exhibited as an emetic, unless there be symptoms of determination to the brain, or of inflammation of the digestive organs. A senna draught, with a calomel pill, forms a good purgative. To enable it to sit well on the stomach, cinchona (or the

¹ See some remarks on periodic movements, in Müller's *Elem. of Phys.* by Baly, vol. i. p. 924

² *Pyretologia*.

³ *Comment. art. Feb. Inter.*

⁴ *Mat. Med.* ii. 96.

sulphate of quina) is frequently given in conjunction with aromatics. The infusion or decoction of cinchona, though much less effective, is, however, less liable to disturb the stomach than the powder of cinchona or the sulphate of quina. Opium is sometimes a necessary adjunct to cinchona to prevent its running off by the bowels. In some cases where the stomach was too irritable to admit of the administration of cinchona or sulphate of quina by the mouth, these agents have been otherwise introduced into the system. Thus, *clysters* of cinchona were used by Helvetius, Torti, and Baglivi.¹ Van Swieten² says he has often seen this method successful in infants, but that it takes three times as much bark as would suffice if the remedy were swallowed. *Cataplasms* of cinchona have also been employed. Rosenstein applied them to the abdomen, Torti to the wrist.³ Alexander⁴ cured an ague by a *pediluvium* of decoction of cinchona, but Heberden⁵ tried it without success. *Bark jackets* were employed with success in the agues of children, by Dr. Pyc.⁶ They consisted of waistcoats between whose layers powdered cinchona was quilted. The dry powder of cinchona has been *applied to the skin*; thus, Dr. Darwin strewed it in the patient's bed. Chrestien⁷ successfully used the tincture and alcoholic extract by the *iatroleptic method*. More recently, sulphate of quina has been employed in the same way. The last-mentioned operation has also been applied by the *endermic method*;⁸ but this mode of using it is sometimes attended with intense pain and an eschar.⁹ To infants at the breast, Rosenstein advises its indirect exhibition *by the nurse*, in whose milk its active principle is administered to the child.¹⁰ More recently, sulphate of quina mixed with tobacco (in the proportion of fifteen grains of the former to an ounce of the latter) has been employed as a *snuff* in intermittent headache.

Cinchona and its preparations prove most successful in the simple or uncomplicated form of intermittents; that is, where the disease appears to be purely nervous. But when agues are accompanied with inflammatory excitement or with visceral disease, cinchona generally proves either useless or injurious. In remittents it proves much less successful than in regularly-formed intermittents. In all these cases we endeavour to promote the efficiency of the cinchona by reducing the disease to the form of a pure or simple intermittent. The means to effect this must of course depend on a variety of circumstances; but bloodletting, both general and local, purgatives, and diaphoretics, are those which for the most part will be found available. Under some circumstances, mercury given in alterative doses, or even as a very slight sialogogue, proves beneficial.

Intermittent fevers are not the only periodical diseases in which cinchona has been found beneficial. It is a remedy which has proved serviceable in several other cases in which a paroxysm (of pain, spasm, inflammation, hemorrhage, or fever) returns at stated periods. Thus, intermittent neuralgia, rheumatism, headache, amaurosis, catarrh, ophthalmia, stricture, &c. have been greatly benefited by its use. Some of these affections have been regarded as *masked agues*. When periodical diseases recur at uncertain periods, as in the case of epilepsy, no particular advantage can be expected from the use of cinchona.

2. *In continued fever*.—In the latter stage of continued fever, when the vital powers are beginning to sink, and when there is no marked and decided symptom of inflammatory disease of the brain or digestive organs, cinchona or sulphate of quina sometimes proves highly beneficial. If the tongue be dry, as well as furred, and the skin hot and dry, no advantage, but the reverse, can be anticipated from its employment. It is most applicable to the low forms of fever occurring in debilitated constitutions. When exacerbations or remissions, however indistinct, occur at regular periods, the administration of cinchona is the more likely to be followed

¹ Murray, *App. Med.* i. 871.

² Murray, *op. cit.* 872.

³ Comment.

⁴ *De la Méthode Iatrolept.* 232 and 270.

⁵ Trousseau and Pidoux, *Traité de Thérap.* ii. 219.

⁶ *Commentaries*, vii. 277.

⁷ *Exper. Essays*, 38.

⁸ *Med. Obs. and Inq.* ii. 245.

⁹ *Archiv. Gén. de Méd.* 1826; *Revue Méd.* 1827.

¹⁰ *Ibid.* 231.

by good effects. Under the preceding circumstances there can scarcely be two opinions as to the admissibility of bark. But on the general propriety of administering this remedy in continued fever, considerable difference of opinion has prevailed.¹ Dr. Heberden² cautiously observes: "I am not so sure of its being useful, as I am of its being innocent." In order to avoid offending the stomach, it is frequently advisable to begin with the infusion, for which, afterwards, first the decoction, then the sulphate of quina, may be substituted. In the stage of convalescence, the use of cinchona or sulphate of quina may often be advantageously preceded by infusion of calumba; without this precaution, irritation of the stomach or febrile symptoms are readily set up.

3. *In inflammatory diseases.*—As a general rule, stimulants and tonics, as cinchona, are improper in inflammatory diseases. Yet to this statement, which applies principally to the first stage, to acute and active cases, and to the disease when it occurs in strong and vigorous habits, many exceptions exist. Thus, when it takes place in old and debilitated constitutions; when it is of a mild or atonic character, and has existed for some time without giving rise to any obvious organic changes; when it assumes an intermittent or even remittent form; or when it is of a certain quality, which experience has shown to be less benefited by ordinary antiphlogistic measures, cinchona is sometimes admissible and advantageous after evacuations have been made proportioned to the activity of the disease and the vigour of the system. *In scrofulous inflammation* (as of the eye) its value is fully appreciated. *In rheumatism*, in which disease Morton, Fothergill, Saunders, and Haygarth, have so strongly recommended it, its use is now obsolete, except under circumstances similar to those which regulate its employment in ordinary inflammation. The same remarks apply to its employment in *erysipelatous inflammation*, in which it was at one time much esteemed.

4. *In maladies characterized by atony and debility.*—Cinchona is useful in a great variety of diseases dependent on, or attended by, a deficiency of tone or strength, as indicated by a soft and lax condition of the solids, weak pulse, incapability of great exertion, impaired appetite, and dyspeptic symptoms. Thus, *in chronic atonic affections of the alimentary canal*, it proves very serviceable, especially in some forms of dyspepsia and anorexia. In these, it should be given half an hour or an hour before meal-times. *In some chronic maladies of the nervous system*, as chorea, when it occurs in delicate girls; also, in the neuralgia of weakly subjects. Disulphate of quina has been used by Dr. Bright³ in tetanus. *In mortification*, it is useful in those cases in which tonics and astringents are obviously indicated; but it has no specific power of checking the disease, as was formerly supposed. *In passive hemorrhages*, from relaxation of vessels, as in some cases of profuse menstruation, or uterine hemorrhage consequent on miscarriage. *In profuse mucous discharges* with great debility, as in leucorrhœa, excessive bronchial secretion, old diarrhœas, &c. *In cachectic diseases*, as enlargements and indurations of the absorbent glands, of a scrofulous nature, strumous ophthalmia, obstinate ulcers, &c.⁴ Also in venereal diseases, when the secondary symptoms occur in shattered and broken-down constitutions, and after the full use of mercury. Likewise in some of the chronic skin diseases, which are seen in cachectic habits.

5. *In the convalescence* of either acute or chronic lingering diseases, as fever, inflammation, hemorrhage, profuse suppuration, &c.; also after important surgical operations, when the strength is greatly reduced. In no class of cases is the efficacy of cinchona or its alkaloids more manifest than in these.

6. *As a topical astringent and antiseptic.*—The efficacy of cinchona as an astringent and antiseptic depends on tannic acid. But as many vegetable substances exceed cinchona in the quantity of this acid which they contain, so they surpass it in astringency. Hence, the topical uses of bark are comparatively unimportant;

¹ Clutterbuck, *On the Seat and Nature of Fever*, 399, 2d edit. 1825.

² *Comment.*

⁴ See Dr. J. Fordyce, *Med. Obs. and Inq.* ii. 181.

³ *Guy's Hospital Reports*, vol. i.

and, for the most part, are nearly obsolete. Powdered cinchona is frequently employed as a tooth-powder. Formerly, it was used as an application to mortified parts, foul ulcers, caries, &c. The decoction, with or without hydrochloric acid, is applied as a gargle in putrid sore throat.

7. *As a chemical antidote.*—The value of cinchona bark, as a chemical antidote, depends on its tannic acid. I have already offered some observations on its employment in poisoning by emetic tartar (see vol. i. p. 670). I believe, in all cases, it might be advantageously replaced by other and more powerful astringents; as nutgalls, or, on an emergency, green tea.

ADMINISTRATION.—In the form of *powder*, cinchona is now rarely administered. The bulk of a full dose, its disagreeable taste, its tendency to cause nausea and vomiting, and the quantity of inert woody fibre which it contains, form great objections to its employment. Yet, of its great efficacy, as a febrifuge or antiperiodic, in intermittents, and of its superiority in these cases to the decoction or infusion, no doubt can exist; but sulphate of quina has almost entirely superseded it. The dose of the powder of cinchona is from a scruple to a drachm, or even more than this when the stomach can bear it.

1. *INFUSUM CINCHONÆ, L. E.; Infusion of Bark.*—(Yellow Cinchona [any species of Cinchona, according to prescription, *E.*], bruised [in powder, *E.*], $\mathfrak{z}\text{j}$; Boiling [Distilled, *L.*] Water Oj. Macerate for two [four, *E.*] hours in a covered vessel, and strain [through linen or calico, *E.*].)—Water extracts from cinchona bark the kinates of quina, cinchonia, and lime, gum, soluble red cinchonic (tannic acid) and yellow colouring matter. The greater part of the cinchona alkaloids remain in the marc, as a very small quantity only of the compound of red cinchonic and the cinchona alkaloids is extracted. The London College has very properly directed yellow bark (the most powerful of the cinchona barks) to be used in the preparation of the infusion.—The infusion of cinchona is stomachic and tonic, but is scarcely energetic enough to be febrifuge. It is a light preparation, applicable as a tonic where the stomach is very delicate, and cannot support the more active preparations of this medicine.—The dose is $\mathfrak{f}\mathfrak{z}\text{j}$ to $\mathfrak{f}\mathfrak{z}\text{ij}$ thrice a day.

2. *INFUSUM CINCHONÆ PALLIDÆ, L.; Infusum Cinchonæ, D.; Infusion of Pale Bark.*—(Prepare this in the same manner as Infusum Cinchonæ, *L.*—Take of Peruvian Bark (Crown or Pale), in coarse powder, $\mathfrak{z}\text{j}$; Boiling Water Oss. Infuse for one hour in a covered vessel, and filter through paper. The product should measure about eight ounces, *D.*)—Dose, $\mathfrak{z}\text{j}$ to $\mathfrak{z}\text{ij}$. This infusion is inferior to the preceding in activity, and is a very unnecessary one. It is said to oppress the stomach less than that of the other cinchona bark; the reason is obvious—it is weaker.

[The *U. S. Pharm.* directs the *Infusum Cinchonæ Flavæ* as the Infusum Cinchonæ above directed, and in the same way the *Infusum Cinchonæ Rubræ*.]

3. *INFUSUM CINCHONÆ SPISSATUM, L.; Inspissated Infusion of Bark.*—(Yellow Cinchona, coarsely bruised, $\mathfrak{lb}\text{ij}$; Distilled Water Ovj; Rectified Spirit, as much as may be sufficient. Macerate the cinchona in the same manner as we have directed the Extractum Cinchonæ to be prepared, and strain. Evaporate the mixed infusions in a water-bath, to a fourth part, and set aside that the dregs may subside. Pour off the clear liquor, and strain what remains. Then mix them, and again evaporate until the sp. gr. of the liquor becomes 1.200. Into this, when it has become cold, drop the spirit very slowly, that three fluidrachms may be added to each fluidounce of the liquor. Lastly, set aside the liquor for twenty days, that the dregs may entirely subside.)—Concentrated solutions of this kind have long been in use, to save trouble in preparing the ordinary infusion. The inspissated infusion of the College is said to be from twenty-four to thirty-six times the strength of the pharmacopœial ordinary infusion; but it is obvious that the preparation must

be liable to variation in strength. In a general way, f3j may be considered equal to f3ij of the infusion.

4. INFUSUM CINCHONÆ PALLIDÆ SPISSATUM, L.; *Inspissated Infusion of Pale Bark*.—(Prepare this in the same manner as Infusum Cinchonæ Spissatum.)—An unnecessary preparation. Its properties are similar to those of the preceding preparation, but its strength is less.

[5. INFUSUM CINCHONÆ COMPOSITUM, U.S.; *Compound Infusion of Cinchona Bark*. Take of Red Bark, in powder, an ounce; Aromatic Sulphuric Acid a fluidrachm; Water a pint. Macerate for twelve hours, occasionally shaking, and strain. It may also be prepared by displacement.]

6. DECOCTUM CINCHONÆ, L. E.; *Decoction of Bark*.—(Yellow Bark, bruised, 3x; Distilled Water Oj. Boil for ten minutes in a covered vessel, and strain the liquor while hot, L.—Crown, Gray, Yellow, or Red Cinchona, bruised, 3j; Water f3xxiv. Mix them, boil for ten minutes, let the decoction cool, then filter it, and evaporate to sixteen fluidounces, E.)—The preparation of the London College becomes turbid on cooling; the Edinburgh College directs the preparation to be filtered after it has become cold.

By boiling, water extracts from cinchona the kinates of quina, cinchona, and lime, gum, soluble red cinchonic (tannic acid), yellow colouring matter, starch, and a portion of the compound of the red cinchonic with the cinchona alkaloids. While hot, the liquor is transparent; but as it cools, it becomes turbid—owing partly to the deposition of the tannate of starch when the temperature falls below 88° F., and partly because the red cinchonic compound, being more soluble in hot than in cold water, is deposited on cooling. If the deposit, with a portion of the supernatant liquor, be poured off and gently heated, it is dissolved. The sesquichloride of iron almost blackens it; a few drops of sulphuric acid and a few drops of solution of iodine render it bluish-black—indicative of the presence of starch. Of 146 parts of the deposit from decoction of yellow (Calisaya) bark, Soubeiran¹ found 60 parts (principally tannate of starch) were insoluble in alcohol, and the remaining 86 parts were readily soluble in alcohol, and yielded the cinchona alkaloids. The same author also found that, by decoction, yellow (Calisaya) bark lost two-thirds of its weight; whereas, by infusion, it merely lost one-third of its weight. If the water employed in preparing the decoction or infusion be acidulated (with sulphuric or hydrochloric acid), the medicinal value of the preparation is greatly increased; for the acid decomposes the insoluble red cinchonic salt, and forms with the cinchona alkaloids a soluble combination. Alkaline solutions, on the other hand, yield less powerful, though highly coloured, preparations; they readily dissolve the red cinchonic and the acids, but they render the alkaloids insoluble. Decoction of cinchona is stomachic, tonic, and febrifuge. The dose is f3j to f3ij.

7. DECOCTUM CINCHONÆ PALLIDÆ, L.; *Decoction Cinchonæ, D.*; *Decoction of Pale Bark*.—(Prepared like Decoction Cinchonæ, L.—Take of Peruvian Bark [Crown or Pale], in coarse powder, 3ss; Water Oss. Boil for ten minutes in a covered vessel, and strain while hot. The product should measure about eight ounces, D.)—The properties, uses, and doses are like the preceding preparation, than which it is weaker.

8. DECOCTUM CINCHONÆ RUBRÆ, L. [U. S.]; *Decoction of Red Bark*.—(Prepared like Decoction Cinchonæ.)—Its properties, uses, and doses are similar to those of Decoction Cinchonæ, L.—[The U. S. Pharm. likewise directs the *Decoction Cinchonæ Flavæ*.]

9. TINCTURA CINCHONÆ, L. E. [U. S.]; *Tincture of Bark*.—(Yellow [Yellow, or any other species, according to prescription, E.] Cinchona, bruised [in fine pow-

¹ *Traité de Pharm.* i. 607.

der, *E.*], ℥viiij [℥vj, *U. S.*]; Proof Spirit Oij [Diluted Alcohol Oij, *U. S.*]. Macerate for seven [fourteen, *U. S.*] days, then express and strain. The directions of the *Edinburgh College* are as follows: "Percolate the bark with the spirit, the bark being previously moistened with a very little spirit, left thus for ten or twelve hours, and then firmly packed in the cylinder. This tincture may also be prepared, though much less expeditiously, and with much greater loss, by the usual process of digestion, the bark being in that case reduced to coarse powder only."—Spirit extracts all the bitter and astringent principles of cinchona—both the kinates of the cinchona alkaloids, as well as the combination of these substances with the red cinchonic. If the spirit be too concentrated, the kinates are less readily dissolved by it. Tincture of cinchona is stomachic, tonic, and stimulant.—The dose of it is fʒj to fʒiij. It is usually employed as an adjuvant to the infusion or decoction of cinchona, or to the solution of the disulphate of quina.

10. TINCTURA CINCHONÆ PALLIDÆ, *L.*; *Tinctura Cinchonæ*, *D.*; *Tincture of Pale Bark*.—(Prepared like *Tinctura Cinchonæ*, *L.*—Take of Peruvian Bark [Crown or Pale], in coarse powder, ℥viiij; Proof Spirit Oij. Macerate for fourteen days, strain, express, and filter, *D.*)—Properties, uses, and doses as the preceding preparation, than which it is weaker.

11. TINCTURA CINCHONÆ COMPOSITA, *L. E. D.* [*U. S.*]; *Compound Tincture of Bark*.—(Pale Cinchona [Yellow Bark, *E.*], [Red Bark, *U. S.*], bruised [coarsely powdered, *D. E.*; fine, if percolation be followed, *E.*], ℥iv; Orange Peel [Bitter, *E. D.*], dried [bruised, *E.*], ℥iij [℥ij, *D.*]; Serpentry, bruised, ℥vj; Saffron [chopped, *E. D.*] ℥ij; Cochineal, powdered, ℥j; Proof Spirit Oij. Digest for seven [fourteen, *D.*] days, then express and strain. "Digest for seven days; strain and express strongly; filter the liquors. This tincture may also be conveniently prepared by the method of percolation, in the same way as the compound tincture of cardamom," *E.*)—[The proportions of the *U. S. Pharm.* are, Peruvian Bark, in powder, ℥ij; Orange Peel, bruised, ℥iss; Virginia Snake-Root, bruised, ℥iij; Saffron, cut, Red Saunders, rasped, āā ℥j; Diluted Alcohol fʒxx. Macerate for fourteen days, and filter, or proceed by displacement.] This is usually sold as *Husham's Tincture of Bark*. It is a more agreeable and more stimulant, though less powerful, tonic than the simple tincture, and is less apt to disturb the stomach. Made according to the London Pharmacopœia, it contains one-half less cinchona than the simple tincture. It is employed as a tonic and stomachic.—The dose of it is fʒj to fʒiij.

12. EXTRACTUM CINCHONÆ, *L. E.*; *Extract of Bark*.—(Yellow Bark, coarsely bruised, lbij; Distilled Water Ovj. Add four pints of water to the cinchona, and stir constantly with a spatula until the bark is thoroughly moistened; macerate for twenty-four hours, and strain through linen. Macerate the residuum in the remaining water for twenty-four hours, and strain. Then evaporate the mixed liquors to a proper consistence, *L.*—Take any of the varieties of Cinchona, but especially the Yellow or Red Cinchona, in fine powder, ℥iv; Proof Spirit fʒxxiv. Percolate the cinchona with the spirit; distil off the greater part of the spirit; and evaporate what remains in an open vessel over the vapour-bath to a due consistence, *E.*)—The *watery extract of cinchona* (*extractum cinchonæ*, *L.*) contains the same constituents already mentioned as being found in decoction of bark. Mr. Brande says lance-leaved (*i. e.* pale) bark yields 30 per cent. of watery extract. The active principles of this preparation are the kinates of the cinchona alkaloids. The *spirituous extract* (*extractum cinchonæ*, *E.*) is a more efficacious preparation, as it contains, besides the alkaline kinates, the compound of the red cinchonic with the cinchona alkaloids. When prepared with rectified spirit, 24 per cent. of extract is obtained from pale bark. But as the *Edinburgh College* direct proof spirit to be employed, the produce is larger.—Well-prepared (*i. e.* not decomposed by evaporation) extract is a very useful preparation, which, however, has been nearly superseded by sulphate of quina. It is given in the form of pill, in doses of from grs. v

to grs. xx. The watery extract may be dissolved in water or in infusion of roses; and for administration to children, in syrup of mulberries or of orange-peel. Extract of bark, however, is rarely employed in medicine.

13. *EXTRACTUM CINCHONÆ PALLIDÆ*, L.; *Extract of Pale Bark*.

14. *EXTRACTUM CINCHONÆ RUBRÆ*, L.; *Extract of Red Bark*.

These two extracts are prepared in the same manner as *Extractum Cinchonæ*, L.—[The *Extractum Cinchonæ Flavæ*, U. S. is thus prepared: Take of Yellow Bark, in coarse powder, a pound; Alcohol, four pints; Water, a sufficient quantity. Macerate the Peruvian Bark with the Alcohol for four days; then filter by means of percolation, and when the liquid ceases to pass, pour gradually upon the Bark sufficient Water to keep its surface covered. When the filtered tincture measures four pints, set it aside, and proceed with the filtration until six pints of infusion are obtained. Distil off the alcohol from the tincture and evaporate the infusion, till the liquids respectively are brought to the consistence of thin honey; then mix them and evaporate so as to form an extract.]—The *Extractum Cinchonæ Rubræ*, U. S., is prepared in the same manner.

15. *QUINÆ DISULPHAS*, L.; *Quinæ Sulphas*, E. D. [U. S.]; *Sulphate of Quinine*, offic.; *Subsulphate of Quina*.—[Although the *Disulphate of Quinine* is now placed by the London College among the articles of *Materia Medica*, we have considered it proper to retain the author's description of the method of preparing this salt according to the formula of previous editions of the *Pharmacopœia*.—Ed.]

Take of Heart-leaved Cinchona, bruised, lbvj; Sulphuric Acid ξ ix; Purified Animal Charcoal ξ ij; Hydrated Oxide of Lead, Solution of Ammonia, Distilled Water, each as much as may be sufficient. Mix four ounces and two drachms of the Sulphuric Acid with six gallons of distilled Water, and add the Cinchona to them: boil for an hour, and strain. In the same manner again boil what remains in Acid and Water, mixed in the same proportions, for an hour, and again strain. Finally, boil the Cinchona in eight gallons of distilled water, and strain. Wash what remains frequently with boiling distilled water. To the mixed liquors add Oxide of Lead, while moist, nearly to saturation. Pour off the supernatant liquor, and wash what is thrown down with distilled water. Boil down the liquors for a quarter of an hour, and strain; then gradually add Solution of Ammonia to precipitate the Quina. Wash this until nothing alkaline is perceptible. Let what remains be saturated with the rest of the Sulphuric Acid, diluted. Afterwards, digest with two ounces of Animal Charcoal, and strain. Lastly, the Charcoal being thoroughly washed, evaporate the liquor cautiously, that crystal may be produced.

Mr. Phillips¹ gives the following explanation of this process. "The quina exists in combination with a peculiar acid, called Kinic Acid, forming with it Kinate of Quina, which is soluble to a certain extent in water, and is rendered more so by the sulphuric acid employed in the process, and perhaps by decomposing it. Whatever may be the state of combination, the solution contains sulphuric acid, kinic acid, and quina, mixed with extractive and colouring matter, the latter being got rid of by the animal charcoal. On adding oxide of lead the sulphuric acid combines with it, and the resulting sulphate being insoluble is precipitated, while the kinic acid and quina remain in solution; when ammonia is added, after the separation of the sulphate of lead, the kinic acid unites with it, and the kinate of ammonia formed is soluble, while the quina is precipitated, and this, when afterwards combined with sulphuric acid, forms disulphate of quina, which crystallizes."

The directions of the *Edinburgh College* for the preparation of disulphate of quina are as follows:—

Take of Yellow Bark, in coarse powder, one pound; Carbonate of Soda, eight ounces; Sulphuric Acid, half a fluidounce; Purified Animal Charcoal, two drachms. Boil the bark for an hour in four pints of water, in which half the carbonate of soda has been dissolved; strain, and express strongly through linen or calico; moisten the residuum with water, and express again, and repeat this twice. Boil the residuum for half an hour with four pints of water, and add the sulphuric acid; strain, express strongly, moisten with water, and express again. Boil

¹ *Transl. of the Pharm.*

residuum with three pints of water and a fourth part of the acid; strain and squeeze as before. Boil again the residuum with the same quantity of water and acid; strain and squeeze as formerly. Concentrate the whole acid liquors to about a pint; let the product cool; filter it, and dissolve in it the remainder of the carbonate of soda. Collect the impure quina on a cloth, wash it slightly, and squeeze out the liquor with the hand. Break down the moist precipitate in a pint of distilled water; add nearly one fluidscruple of sulphuric acid, heat it to 212° , and stir occasionally. Should any precipitate retain its gray colour, and the liquid be neutral, add sulphuric acid, drop by drop, stirring constantly, till the gray colour disappears. Should the liquid reddened litmus, neutralize it with a little carbonate of soda. Should crystals form on the surface, add boiling distilled water to dissolve them. Filter through paper, preserving the funnel hot; set the liquid aside to crystallize; collect and squeeze the crystals; dissolve them in a pint of distilled water heated to 212° , digest the solution for fifteen minutes with the animal charcoal; filter, and crystallize as before. Dry the crystals with a heat not exceeding 140° .

The mother-liquors of each crystallization will yield a little more salt by concentration and cooling.

The object of this process is to extract, by means of the solution of carbonate of soda, the acids, the colouring and extractive matters, the gum, &c. from the bark, but leaving the cinchona alkaloids. Stolze used for this purpose lime; Badollier and Scharlau caustic potash. The alkaline decoction has a very deep colour. By boiling the residuum in water acidulated with sulphuric acid, the alkaloids are dissolved. On the addition of carbonate of soda, double decomposition takes place, and the impure quina is precipitated. This is afterwards dissolved in water acidulated with sulphuric acid, and the filtered liquid is set aside to crystallize. The impure disulphate of quina thus obtained is redissolved in boiling water, and the solution, after being decolorized by digestion with animal charcoal, is filtered, and put aside to crystallize.

I have repeated this process, which has the great merit of obviating the use of alcohol, and I believe it to be an excellent one, combining both simplicity and economy. In one experiment, I employed one pound of picked uncoated yellow (Calisaya) bark, and found that the precipitated impure quina required two fluidscruples and five minims of sulphuric acid to saturate it, instead of one fluidscruple, directed by the Edinburgh College. In another experiment, I could not get the impure sulphate of quina to crystallize until it had been digested with animal charcoal.

The process of the *Dublin College* is similar to the method of manufacturing disulphate of quina which has been usually followed by *manufacturers* in this country; it is as follows:—

Coarsely pulverized yellow (Calisaya) bark is boiled with water acidulated with sulphuric or hydrochloric acid. The residuum boiled a second or a third time with acidulated water. Some repeat the process a fourth time. Finely-powdered slacked lime is added to the filtered decoction (when cold), until the liquor is sensibly alkaline, and acquires a dark colour. The precipitate is collected, drained on a cloth, and then submitted to graduated pressure (usually in a hydraulic press). The cake thus obtained is, when dry, reduced to powder, and digested in rectified spirit. The filtered tincture is distilled until the residuum (impure quina) in the retort has a brown viscid appearance. This residuum is then to be carefully saturated with very diluted sulphuric acid, the solution filtered, and set aside to crystallize. The disulphate of quina thus obtained is yellowish-brown. It is drained in a cloth, compressed, dissolved in water, decolorized by animal charcoal, recrystallized, and dried. This last part of the process must be very carefully conducted, to avoid efflorescence.

Some persons think it preferable to convert the quina of this alcoholic solution into a sulphate before distillation, in order to separate the fatty matter. I am informed, by a maker of this salt, that the use of spirit in the process does not, on the large scale, add much more than a penny an ounce to the cost of the disulphate, as the greater part is recovered.

On the large scale, the decoction of the bark is usually prepared in a large vat, the boiling being effected by steam. The acidulated decoction contains the quina, the cinchonia, the yellow colouring matter, the red cinchonic, the kinic, and the sulphuric (or hydrochloric) acids. The lime saturates all the acids, and forms soluble salts (if sulphuric acid have been employed, sulphate of lime is formed, the greater part of which precipitates), which remain in the liquid with a portion of red colouring matter. The precipitate is composed of quina, cinchona, a combina-

tion of lime and red cinchonic, fatty matter, excess of lime, and when sulphuric acid has been employed, sulphate of lime; the whole is contaminated with colouring matter. Alcohol extracts from this precipitate the quina and cinchonia, the fatty matter, and the colouring matter; leaving undissolved the excess of lime, the compound of lime with the red cinchonic, and, when sulphuric has been used, sulphate of lime. The sulphuric acid being then added to the impure quina, converts it into a disulphate. On account of the expense of spirit of wine, various substitutes have been proposed. Pyroxilic spirit has been tried; but I believe has not answered. Pelletier has taken out a patent for the employment of a volatile oil (oil of turpentine). The dried cake of quina and lime, obtained in the usual manner, is to be digested in oil of turpentine, which dissolves the quina. The oleaginous solution is then to be agitated with water acidulated with sulphuric acid, by which a sulphate of quina is obtained. By repose, the oil rises to the top, and after removal may be employed again, while the solution of the sulphate is to be evaporated as usual. Hitherto, however, this process has not succeeded, partly because the turpentine does not extract more than nineteen-twentieths of the quina present. If any attempts, however, should be made to procure the disulphate in America, it is possible that some modification of this process would be the best.

Disulphate of quina occurs in small, fibrous, odourless, very bitter crystals, which have a pearly aspect, and a flexibility like amianthus. Exposed to the air, they effloresce slightly. When heated, they become luminous; friction promotes this phosphorescence. At 240° F. they melt like wax; at a more elevated temperature the salt assumes a fine red colour; and when ignited in the air burns, leaving at first a carbonaceous residuum, but which is subsequently dissipated. One part of this salt requires 80 parts of cold alcohol (sp. gr. 0.850) or 740 parts of cold, or 30 parts of boiling water to dissolve it; as the saturated solution cools, part of the salt separates. A remarkable property of this salt is to give a blue tinge to the surface of quina (see *Quina*, ante). The following is the composition of this salt:—

	Atoms.	Eq. Wt.	Per. Cent.
Sulphuric Acid	1	40	9.17
Quina	2	321	74.31
Water	8	72	16.52
Crystallized Disulphate of Quina	1	436	100.00

By exposure to the air the crystals lose 4 (Soubeiran says 6) equivalents of water, equal to about eight per cent. When fused they evolve two more equivalents. One hundred grains of the crystals dissolved in water, acidulated with hydrochloric acid, yield, by the addition of chloride of barium, a quantity of sulphate of baryta, which, when ignited, weighs 26.6 grs. For the tests, see *Quina*, ante.

Adulterations.—Various foreign bodies (as earthy and alkaline salts, gum, sugar, starch, fatty matters, sulphate of cinchonia, and salicine) are, it is said, occasionally intermixed with disulphate of quina. The following are the tests by which the presence of these bodies is ascertained: By digesting disulphate of quina in alcohol this salt is dissolved, leaving any alkaline or earthy sulphates, gum, or starch, that may be present. Gum is soluble in cold water; starch is coloured blue by a solution of iodine. When heated in the open air the disulphate of quina is burned and dissipated; the earthy salts, on the other hand, are left. The disulphate is soluble in water acidulated with sulphuric acid, whereas, fatty matters are insoluble. To detect sugar, add to a solution of the disulphate, carbonate of potash: quina is precipitated, while sulphate of potash and sugar are left in solution; the latter may be detected by its sweet taste, or by evaporating the liquid to dryness, and digesting the residue with spirit, which dissolves the sugar, but leaves the sulphate. Ammoniacal salts are detected by the ammoniacal odour emitted on the addition of caustic potash. Salicine may be recognized by oil of vitriol, which turns it red. Sulphate of cinchonia may be made to crystallize in a pulverulent form, by stirring the solution, and in this state it may be readily intermixed with

disulphate of quina. This fraud, I suspect, has been recently carried on to no very slight extent. To detect it, precipitate a solution of the suspected salt in water by potash; collect the precipitate, and boil it in alcohol. The cinchona crystallizes as the liquor cools, while the quina remains in the mother-liquor.

The characteristic marks of the purity of disulphate of quina are, according to the *London College*, as follows:—

“It is dissolved by water, especially when mixed with an acid. Quina is thrown down by ammonia; the liquor being evaporated ought not to taste of sugar. One hundred parts of disulphate of quina lose eight or ten parts of water by a gentle heat. It is destroyed by heat. Chlorine being first added to it, and afterwards ammonia, it becomes green.” From 100 grains dissolved in water mixed with hydrochloric acid, 26.6 grains of sulphate of barytes, dried at a red heat, are obtained.

The characters given by the *Edinburgh College* are as follows:—

“A solution of ten grains in a fluidounce of distilled water, and two or three drops of sulphuric acid, if decomposed by a solution of half an ounce of carbonate of soda, in two waters, and heated till the precipitate shrinks and fuses, yields, on cooling, a solid mass, which, when dry, weighs 7.4 grains, and in powder dissolves entirely in a solution of oxalic acid.”

The quantity of carbonate of soda required to decompose 10 grs. of disulphate of quina, to which a few drops (say six grains) of sulphuric acid have been added, is less than twenty-five grains.¹

Disulphate of quina is given in doses of from gr. j to grs. v. Occasionally, it is exhibited in much larger doses as a febrifuge; but it is very apt to disagree, causing disturbance of stomach, febrile disorders, and headache. I have known fourteen grains taken, and have heard of a scruple or half a drachm being exhibited at a dose. It may be given either in the form of pill, made with conserve of roses, or dissolved in some aqueous liquid by the aid of an acid. Infusion of roses is a favourite vehicle for it. An ointment (composed of ʒj of disulphate of quina and ʒij of lard) rubbed into the axilla has been used with success to cure ague in children.²

16. *TINCTURA QUINÆ COMPOSITA*, L.; *Compound Tincture of Quinine*.—(Disulphate of Quinine ʒv and ʒj; Tincture of Orange Oij. Digest for seven days, or until the quinine be dissolved, and strain.)—The solution is hastened by digesting the mixture in a warm place. Mr. Squire states that in seven days only 39-40ths of the quinine are dissolved. Every fluidrachm contains about one grain of the disulphate.—Dose, fʒj to fʒij, or more.

17. *QUINÆ MURIAS*, D.—A process for preparing this salt is given in the *Dublin Pharmacopœia*. It is procured in decomposing a solution of Disulphate of Quina by a solution of Chloride of Barium. It is employed in the preparation of the Valerianate of Quinine.

18. *QUINÆ VALERIANAS*, D.—This salt is prepared in decomposing Muriate of Quina, by the Valerianate of Soda (see *ante*, p. 615.)

233. UNCARIA GAMBIR, Roxburgh.—THE GAMBIR.

Nauclea Gambir, *Hunter*.

Sex. Syst. Pentandria, Monogynia.

(The extract obtained from the leaves, *E.*; Gambir, or Gambir-Catechu.)

HISTORY.—*Gambir*, or *Gambir*, is the Malay name of an extract obtained from the leaves of this shrub. Rumphius³ has described the plant under the name of *Funis uncatius* or *Dawn Gatta Gambir*.

BOTANY. *Gen. Char.*—Limb of *calyx* short, urceolate, 5-cleft. *Corolla* funnel-shaped; tube slender; throat naked; lobes 5, spreading, oval-oblong. *Anthers* inclosed or protruded. *Style* filiform, protruded; *stigma* tumid, undivided. *Capsules* pedicellate, clavate, tapering to the base. *Seeds* numerous, imbricated, winged.—

¹ Mr. R. Phillips, *Lond. Med. Gaz.* Aug. 17, 1839.

² *Herb. Amboin.* vol. v. tab. 34.

³ *Lond. Med. Gaz.* April 3, 1840.

Climbing *shrubs*. *Peduncles* when old becoming axillary compressed hooked spines. *Flowers* in loose heads. (Lindley ; De Cand.)

Sp. Char.—*Branches* terete. *Leaves* ovate-lanceolate, acute, with short petioles, smooth on both sides. *Stipules* ovate. *Peduncles* axillary, solitary, opposite, bracteolated about the middle; the lowest ones sterile, converted into hooked spines. (De Cand.)

A stout, scandant *shrub*. *Florets* green and pink. *Capsules* stalked, elevate, 2-celled, 2-valved.

Hab.—Islands of East Indian Archipelago. Extensively cultivated. On the Island of Bintang there are 60,000 *Gambir plantations*.¹

EXTRACTION OF GAMBIR.—Two methods of obtaining Gambir are described: one consists in boiling the leaves in water, and inspissating the decoction; the other, which yields the best Gambir, consists in infusing the leaves in warm water, by which a fecula is obtained, which is inspissated by the heat of the sun, and formed into cakes.²

Dr. Campbell³ has described the method of making the *circular* or *cylindrical* variety of Gambir, as followed in the colony established by the Sultan of Moco, where the manufacture is carried on to a considerable extent. It consists in shredding and bruising the young shoots and leaves "in water for some hours, until a fecula is deposited; this, inspissated in the sun to the consistence of a paste, is thrown into moulds of a circular form, and in this state the Gambir is brought to market." Dr. Roxburgh⁴ describes the manufacture of the *cubical* variety as practised eastward to the Bay of Bengal. The process consists in "boiling the leaves and young shoots; evaporating the decoction by fire and the heat of the sun. When sufficiently inspissated, it is spread out thin, and cut into little square cakes, and dried." Mr. Bennett⁵ has given a very full account of the method of making the *cubical* variety as practised at Singapore. The leaves are plucked from the prunings, and boiled in a *qualie*, or cauldron (made of bark, with an iron bottom); after being boiled twice and rinsed, they are used as a manure for the pepper vine. The decoction is evaporated to the consistence of a very thick extract, of a light yellowish-brown colour, like clay, which is placed in oblong moulds. The pieces thus obtained are divided into squares, and dried in the sun on a raised platform. Hunter⁶ says, Sago is often intermixed with the extract, but Bennett denies that this is done at Singapore. [The decoction of the leaves is said to be thickened by the manufacturers at Singapore by stirring it with a piece of wood obtained from a tree of the country, which it is to be presumed supplies mucilaginous and starchy matters. Seemann, unfortunately, could not succeed in obtaining this wood from the Chinaman whose laboratory he visited.⁷—ED.] The best Gambir is made at Rhio, in the Isle of Bintang; the next best is that of Lingin.

COMMERCE.—Gambir (the cubical variety) is imported from Singapore principally. Its principal use here is for tanning; and among dealers it is distinguished from catechu, cutch, &c. by the name of *terra japonica*. The following are the quantities imported during the last four years:—⁸

In 1836	970 tons.	In 1838	1600 tons.
1837	273½	1839	5213

During the last three years, its price has varied from 15s. to 26s. per cwt. The duty on it is 1s. per cwt. It is brought over in cane baskets, lined with palm leaves. Mr. Bennett says they are made of a kind of rattan found in the jungle at Singapore.

DESCRIPTION AND VARIETIES.—*Gambir* (*Terra Japonica*, of tanners; *Catechu* in square cakes, of druggists; *Cubical Resinous Catechu*, of Guibourt; *Gambir*

¹ Bennett's *Wanderings*, ii.

² Roxburgh, *Fl. Ind.* i. 515.

³ *Wanderings*, ii. 183.

⁴ Hooker's *Journal of Botany*.

⁵ *Asiatic Researches*, xi. 189.

⁶ *Ibid.*

⁷ *Linn. Trans.* ix.

⁸ Messrs. Powell's *Annual Price Current* for 1840

of *Second Quality*, Bennett),¹ occurs in cubes, whose faces are about one inch square. When thrown into water, it floats. These cubes are externally of a deep reddish or yellowish-brown colour; their fracture is dull and porous, and internally their colour is paler than that of their surface, being yellowish cinnamon brown; the fractured surface not unfrequently presenting some darker feebly shining stripes, extending from without inwards. This kind has no odour; its taste is powerfully astringent and bitter, but subsequently becoming sweetish. It melts entirely in the mouth. When heated in a platinum crucible it undergoes a kind of semifusion, and swells up; and when incinerated leaves a light white ash. Nees v. Esenbeck² says twenty grains of this Gambir leave only half a grain of ash. It is partially soluble in cold water. When boiled in water, it is almost completely dissolved, and yields a decoction which, while hot, is of a clear reddish-brown colour, but, on cooling, becomes turbid, owing to the deposition of catechine. By digestion in ether, it forms a deep reddish-brown tincture, which, by evaporation, yields a reddish-brown astringent extract; the portion which is insoluble in ether is dark-brown, tough and elastic. Examined by the microscope, Gambir is found to consist in great part of myriads of minute crystals (*catechine*) intermixed with a kind of mucous tissue.

Mr. Bennett³ has described three qualities of Gambir, specimens of which are contained in my own collection, as well as in that of the *Medico-Botanical Society of London*. To these I must add a fourth, which I have received from Professor Guibourt.

1. Small Circular Moulded Gambir: *Gambir of the first quality*, Bennett; *Lozenge Gambir*.—This occurs in small round cakes, about the size of a small lozenge. Its form is something like that of a plano-convex lens, slightly flattened on the convex side. One of its surfaces is flat, round, about half an inch in diameter; the other one is convex, with a star like pattern impressed on it. Its colour is pale pinkish yellowish white. It has a chalky or earthy feel, and is brittle. Specimens of this are in the collection of the *Medico-Botanical Society*.

Amylaceous Lozenge Gambir.—Under the name of *Gambir*, or *China Catechu*, I have received from Bombay small circular cakes of Gambir adulterated with sago meal. The cakes are circular and cylindrical, about $3\frac{1}{2}$ lines in diameter, and 2 lines thick; flat at the bottom, and slightly convex at the top. They are grayish yellowish white; have a cretaceous feel, and are easily reduced to powder. Their decoction, when cold, is rendered blue by tincture of iodine. Examined by the microscope, multitudes of particles of sago may be detected, intermixed with crystals of catechine. I have received the same kind of Gambir from Dr. D. MacLagan, of Edinburgh, under the name of *White Gambir*.

2. Gambir in Parallelopipeds: *Gambir of the second quality*, Bennett.—This occurs in two forms: *cubes* (forming the Gambir of English commerce, described in the text) and *square prisms* or *oblong pieces*. The latter I received from Dr. MacLagan, of Edinburgh, under the name of *Yellow Gambir in parallelopipeds*. The length of the prisms is two inches; the size of the terminal faces half an inch square. In other respects the oblong variety agrees with the square kind.

3. Cylindrical Gambir: *Gambir of the third quality*, Bennett.—This occurs in circular disks, or short cylindrical pieces, the length of the cylinder being only about one-third of an inch, while its diameter is one inch and a quarter. One of the round surfaces is marked with the fibres of a cloth, on which the cakes have been dried. The colour internally is pale, dull, pinkish yellow, externally being a shade darker. Its fracture is dull and porous. It is easily scraped to powder with the nail, and in this state has a chalky feel. Its taste is astringent, but less so than the other kinds; it is gritty under the teeth. It sinks in water. The samples in the *Medico-Botanical Society* are somewhat smaller than those which I have found in commerce. This kind contains many impurities.

4. Cubical Amylaceous Gambir.—It is in cubes, which swim in water, and whose faces are about half an inch square. Externally these cubes are dark brown, being darker coloured than the kind just described. Its fracture is dull and porous, its colour internally being pale cinnamon brown. It is readily distinguished from all other kinds of Gambir, by the black colour produced when the tincture of iodine is applied to the fractured surface. When digested in water it is resolved into two parts—

Matter soluble in water	45
Matter insoluble in water, principally amylaceous	55
	<hr/> 100

The amylaceous matter is probably sago.

¹ *Med. and Phys. Journ.* vol. lxxv.

² *Handb. d. med. pharm. Botan.* i. 881.

³ *Med. and Phys. Journ.* lxxvi.

COMPOSITION.—Gambir (the cubical variety) was analyzed by Nees v. Esenbeck,¹ who found *Tannic Acid* 36 to 40 per cent., *Peculiar Matter, Gum or Gummy Extractive, Tannic Deposit* (similar to red cinchonic), and $2\frac{1}{2}$ per cent. of *Woody Fibre*.

1. **TANNIC ACID.**—The properties of this acid have been before (p. 326) described. That extracted from Gambir is soluble in water, alcohol, and ether, and gives a green colour to the salts of iron.

2. **CATECHINE; Catechuic Acid; Tanningensäure,** Buchner; *Resinous Tannin*, Nees.—When Gambir is treated with cold water, an insoluble residuum is left; this is *impure catechine*, and was termed by Nees, *Resinous Tannin*. When obtained quite pure, it is a white, light powder, composed of silky needles, having a peculiar sweet taste. It is very slightly soluble only in cold water, more so in boiling water. Ether, and especially alcohol, are better solvents for it. It produces a green colour with salts of iron, but does not produce a precipitate with a gelatinous solution. Its composition is $C^{15} H^6 O^8$. If it be digested in caustic potash, and the solution exposed to the air, oxygen is absorbed, and the catechuic acid is converted into *Japonic Acid*, composed of $C^{12} H^4 O^4$. But if it be dissolved in carbonate of potash, and exposed to the air without heat, it is converted into *Rubinic Acid*, composed of $C^{24} H^8 O^8$.

PHYSIOLOGICAL EFFECTS.—Gambir is one of the most powerful of the *pure astringents*, whose effects have been before described (see vol. i. p. 201). Its sweet taste depends, in part at least, on catechuic acid.

USES.—It is employed by druggists as catechu (see *Acacia Catechu*).

[Gambir is the name applied to the extract of the leaves, while catechu is the extract of the inner wood.—Ed.]

ORDER LIV. CAPRIFOLIACEÆ, *Jussieu*.—THE HONEY-SUCKLE TRIBE.

CHARACTERS.—*Calyx* superior, 4- or 5-cleft, usually with two or more bracts at its base. *Corolla* superior, monopetalous or polypetalous, rotate or tubular, regular or irregular. *Stamens* epipetalous, equal in number to the lobes of the corolla, and alternate with them. *Ovary* with from 1 to 3 or 4 cells, one of which is often monospermous, the other polyspermous; in the former, the ovule is pendulous; *style* 1; *stigmas* 1, or 3 to 4. *Fruit* indehiscent, 1 or more celled, either dry, fleshy, or succulent, crowned by the persistent lobes of the calyx. *Seeds* either solitary and pendulous, or numerous and attached to the axis; *testa* often long; *embryo* straight, in fleshy albumen; *radicle* next the hilum.—*Shrubs* or *herbaceous* plants, with opposite leaves, destitute of stipules. *Flowers* usually corymbose, and often sweet-scented (Lindley).

PROPERTIES.—Not uniform.

234. SAMBUCUS NIGRA, *Linn.*—COMMON ELDER.

Sex. Syst. Pentandria, Trigynia.

(Flores, *L.*—Flowers, *E.*—Flores, *Baccæ*, *Cortex interior*, *D.*)

HISTORY.—Hippocrates employed the elder (ἀκτῆ) in medicine.

BOTANY. Gen. Char.—Limb of the *calyx* small, 5-cleft. *Corolla* rotate, pitcher-shaped, 5-cleft; its lobes obtuse. *Stamens* 5. *Style* none. *Stigmas* 3, sessile. *Berry* roundish, scarcely crowned, pulpy, 1-celled (Gærtn.), 3- to 5-seeded; funiculi bearing the oblong seeds in the axis of the fruit. (De Cand.)

Sp. Char.—*Stem* shrubby, somewhat arboreous. *Leaves* pinnatisect, smooth; segments ovate-lanceolate, serrate. *Corymbs* 5-partite. (De Cand.)

Stem much and irregularly (though always oppositely) branched, of quick growth; branches (after a year's growth) clothed with smooth gray bark, and filled with a light spongy pith. *Leaflets* deep green, smooth, usually 2-pair, with an odd one. *Cymes* [corymbs] large, smooth, of numerous cream-coloured flowers, with a sweet but faint smell; some in each cyme sessile. *Berries* globular, purplish-black; their stalks reddish (Smith).

Hab.—Indigenous: in hedges, coppices, and woods; common.

DESCRIPTION.—The *liber* or *inner bark* (*cortex interior sambuci*) is collected

¹ *Pharm. Centr.-Blatt für 1830, 45.*

from the branches: its colour is greenish-white; its taste sweetish astringent; its odour feeble. Its infusion is rendered slightly green by the sesquichloride of iron. *Elder flowers* (*flores sambuci*) are white when fresh, but by drying become yellow, and retain an agreeable odour. *Elder berries* (*baccæ sambuci*) yield, by expression, a purple juice, called *elder rob*.

COMPOSITION.—I am unacquainted with any analysis of *elder bark*.¹ The *flowers* were analyzed by Eliason,² who obtained from them *volatile oil*, *acid resin*, *tannic acid*, *oxidized extractive*, *nitrogenous extractive*, *gum*, *wooly fibre*, *glutinous matter*, *albumen*, *malates of potash and lime*, *mineral salts*, and a trace of *sulphur*. *Elder juice* contains *malic acid*, a little *citric acid*, *sugar*, *pectin*, and *colouring matter*, which is reddened by acids, and made green by alkalies.

PHYSIOLOGICAL EFFECTS.—The *flowers*, owing to their volatile oil, are mildly stimulant, and, perhaps, sudorific. The *berries* are cooling, aperient, and diuretic. The *inner bark* (liber) is hydragogue, cathartic, and emetic. The *leaves*, probably, possess similar, though less energetic, properties.

USES.—The *flowers* are seldom employed, except in the preparation of *elder-flower water* and *elder ointment*. The use of the *berries* is now almost solely confined to the manufacture of *elder wine*. The *inspissated juice* of the berries is, however, an official preparation. The *inner bark* has been used as a hydragogue cathartic in dropsy. It may be given in decoction (prepared by boiling 3j of the bark in Oij of water to Oj), in doses of fʒiv. Smaller doses have been used as an aperient and resolvent in various chronic disorders.

1. AQUA SAMBUCCI, L. E.; *Elder Water*.—(Elder Flowers [fresh], ℞x; Water Cong. ij; Rectified Spirit fʒiij, E. Mix them, and let a gallon distil.)—Elder water is frequently made from the *pickled flowers* (*flores sambuci saliti*), which are prepared with alternate layers of the flowers and common salt compressed and preserved in a well-closed vessel [usually a cask]; the water which exudes being rejected. It is principally used as a perfume.

2. UNGUENTUM SAMBUCCI, L.; *Elder Ointment*.—(Elder Flowers, Lard, of each ℞j. Boil the Elder Flowers in the Lard until they become crisp; then press through a linen cloth.)—The *Unguentum Sambuci*, Ph. L., is the *white elder ointment* of the shops. Except in its agreeable odour it has no advantage over spermaceti ointment. It is popularly used as a cooling application to irritable surfaces.

ORDER LV. ARALIACEÆ, Richard.—THE ARALIA TRIBE.

ARALIÆ, Jussieu.

235. Panax quinquefolium.—Ginseng.

1. PANAX QUINQUEFOLIUM, Linn. is a native of North America, growing in the Northern, Middle, and Western States of the Union. Its root is the *American Ginseng* (*radix ginseng*). It is exported to China, where it is highly valued. Pieces of it are said to be occasionally found intermixed with *senega root*.

2. PANAX SCHINSENG, Nees v. Esenbeck, is a native of Asia, and has been usually confounded with the preceding species. Nees admits three varieties: *P. Schin-seng*, var. *Coreanensis*; *P. Schin-seng*, var. *japonica*; and *P. Schin-seng*, var. *nepalensis* (*P. Pseudo-ginseng*, Wallich). The root of this species is the *Asiatic Ginseng* (*radix ninsi*).

The Chinese physicians ascribe the most improbable and extravagant virtues to ginseng. They regard it as an invigorating and aphrodisiac agent. At Peking, it is said to have been sometimes worth its weight in gold! To the taste it is mucilaginous, sweetish, somewhat bitter, and slightly aromatic. In Europe, it is believed to possess very little power.

Fig. 349.



Panax quinquefolium.

¹ Simon has analyzed the bark of the root, and states that its active principle is a soft uncrystallizable resin. Twenty-grains of the alcoholic extract of the bark produced vomiting four or five times, and as many stools (*Journal de Pharmacie*, 1840, p. 247).

² Gmelin, *Handb. de Chém.* ii. 1279.

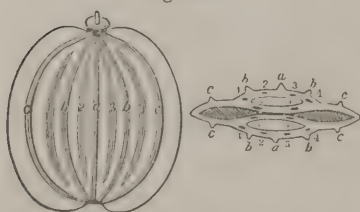
ORDER LVI. UMBELLIFERÆ, *Jussieu*.—THE UMBELLIFEROUS TRIBE.APIACEÆ, *Lindley*.

DIAGNOSIS.—Polypetalous dicotyledons, with definite perigynous stamens, concrete carpella, an inferior ovary of several cells, pendulous solitary ovula, leaves sheathing at the base, umbellate flowers, embryo at the base of fleshy albumen.

CHARACTERS.—Tube of the calyx adherent to the ovary; the limb [superior calyx of *Lindley*] entire, or 5-toothed, or obsolete. *Petals* 5, inserted into the upper part of the calyx [inserted on the outside of a fleshy epigynous disk, *Lindley*], usually inflexed at the point; aestivation imbricate, rarely valvate. *Stamens* 5, alternate with the petals, incurved in aestivation. *Ovary* [inferior, *Lindley*] adherent to the calyx, 2- (rarely 1-) celled, with solitary pendulous ovules: *styles* 2, distinct, incrassated at the base into *stylopodia*, covering the whole of the ovarium;

stigmas simple. *Fruit* (called *diachæna*, *polychæna* or *cremocarpium*, from *κρεμαω*, I suspend, and *καρπος*, fruit) consisting of two *mericarps* (from *μερίς*, a part) (i. e. 2 carpella, with half of the calyx attached, so that they can be called neither *carpella* nor *achenia*), separable from a common axis (*carpophorus*, from *καρπος*, fruit, and *φορέω*, I bear), to which they adhere by their face (*commissure*); the dorsal surface of each carpel is traversed by *ridges*, of which 5 are primary (*costæ*, seu *juga primaria*), and 4 secondary (*juga secundaria*); the latter are sometimes absent; the spaces between the ridges are called *channels* (*valleculæ*). In the channels, within the pericarp, are sometimes linear oily receptacles, called *vittæ*. *Seed* pendulous, usually adhering inseparably to the pericarp, rarely loose; *embryo* minute, pendulous from the apex of the axis (*carpophorus*); *radicle* pointing to the hilum; *albumen* abundant, horny, flat (*Orthosperma*), or rolled inwards at the

Fig. 350.



A.

B.

Fruit of Pastinaca sativa.

A, Dorsal surface.

B, Horizontal section of the fruit.

a, b b, c c, *juga primaria*; 1, 2, 3, 4, 5, 6, *vittæ*.

edges (*Campylosperma*), or rarely curved inwards from the base to the apex (*Calosperma*).—Herbaceous plants, with fistular furrowed *stems*. *Leaves* usually divided, sometimes simple, sheathing at the base. *Flowers* in umbels, white, pink, yellow, or blue, generally surrounded by an *involucre* (condensed from De Candolle).

PROPERTIES.—Extremely variable.

The Umbelliferæ may be thus arranged:—

1. *Umbelliferous carminative fruits used in medicine*:—

Caraway.	Angelica.	Carrot.
Anise.	Dill.	Coriander.
Fennel.	Cumin.	Fænugreek.
2. *Umbelliferous roots used in medicine*:—

Angelica.	Carrot.
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3. *Umbelliferous fetid gum resins*:—

Assafœtida.	Galbanum.	Opoponax.
Sagapenum.	Ammoniacum.	
4. *Narcotic umbelliferæ*:—

Conium.

1. UMBELLIFEROUS AROMATIC OR CARMINATIVE FRUITS.

Vittæ—These are not present in all umbelliferous fruits. They exist, however, in all the fruits now under consideration. In fact, these fruits owe their aromatic and carminative qualities to the oil contained in these vittæ.

a. In general, the *vittæ* are found in the channels or *valleculæ*; and in some cases there is only one—in others there are more than one *vitta* in each channel. Sometimes there are *vittæ* also at the commissure.

Ex.—*Univittate* channels (bivittate commissure): *Caraway*; *Fœniculum*; *Anethum*; *Cumin*; *Carrot*.

Ex.—*Multivittate* channels: *Anise*.

b. In some cases, however, the *vittæ* are not found in the channels, but in the *commissure* only.

Ex.—*Coriander*: commissure bivittate.

The contents of these vittæ is an *oleo-resinous juice*. It is usually deeply coloured. Probably primitively it is oil (volatile) which has become resinified by the air.

Volatile Oil.—When the fruits are submitted to distillation with water, the volatile oil comes over with the water.

The quantity obtained varies with the fruit and a variety of circumstances. In a general way, we may say 4 or 5 per cent. is the amount.

It is probable that in all cases there are two oils obtained from the fruit; one a pure *hydrocarbon*—the other an *oxyhydrocarbon*. At least, in a few cases, by redistilling the oil with caustic potash, we obtain a pure hydrocarbon. In the case of caraway oil, this hydrocarbon (*carum*) has for its formula $C^{10}H^8$. In the case of cumin, it (*cumen*) has a formula $C^{15}H^{24}$.

The *oxyhydrocarbonaceous* oil is probably an acid formed by the union of the *hydrocarbon* with atmospheric oxygen. A still higher oxidation probably furnishes a resin. The agency of the potash, in the distillation, is to fix the acid by combining with it; the non-acid or pure hydrocarbon then distils over.

Dissolved in alcohol we obtain the so called *spirits* (as of *caraway*, *anise*, &c.). Besides the pharmaceutical preparations of this kind, there are analogous ones sold by the spirit dealer under the name of *compounds* or *British liqueurs* (as aniseed, caraway, &c.). These are weaker than the pharmaceutical spirits, and sweetened.

Diffused through, or slightly dissolved in water, these oils impregnate the water with their odour, and to a certain extent with their medicinal properties. *Caraway*, *dill*, *anise*, and other waters, are examples.

Of the properties of the oils individually some remarks will be made hereafter. Those which are subject to fraud or substitution, accidental or purposed, especially deserve notice.

1. *OIL OF FENNEL*.—There are two varieties—the oil of *sweet fennel* and the oil of *wild fennel*. The London College orders *sweet fennel*. The Edinburgh College adopts *Feniculum officinale*. Now, this by botanists is usually regarded as only a variety, perhaps, of the *wild fennel*. Christison says the seed is found among nurserymen as *Florence seed*.

2. *OIL OF ANISE*.—I notice this for the purpose of mentioning that oil of *star-anise* is frequently substituted for it. I know of no ill-consequences likely to result therefrom: one oil is probably as good as another. Still, as there is a difference in price, the substitution of one for the other is a fraud.

Respecting *caraway*, *dill*, *cumin*, *angelica*, and *coriander* fruits (called seeds), I have nothing particular to remark. *Carrot* fruit deserves notice for its structure (see *Daucus Carota*).

236. CARUM CARUI, Linn.—COMMON CARAWAY.

Sex. Syst. Pentandria, Digynia.

(Fructus, L.—Fruit, E.—Semina, D.)

HISTORY.—Caraway is not mentioned in the writings attributed to Hippocrates. Pliny¹ and Dioscorides², however, speak of it: the former calls it *Carcum* (from Caria, its native country)—the latter terms it *καρος*.

BOTANY. Gen. Char.—Margin of the *calyx* obsolete. *Petals* regular, obovate, emarginate, with an inflexed lobe. *Stylopodium* depressed. *Styles* deflexed. *Fruit* contracted at the side, ovate, or oblong. *Mericarps* [half-fruits] with five equal filiform ridges, the lateral ones marginal. *Commissure* flat, bivittate. *Channels* 1-vittate. *Carpophorus* free, forked at the apex. *Seeds* terete-convex, flat in front. —Smooth, often perennial herbs. *Root* tuberous, edible. *Leaves* pinnatisect; the segments many-cleft. *Involucre* variable. *Flowers* white. (De Cand.)

Sp. Char.—*Root* fusiform. *Leaves* bipinnatisect; the lower segments of the branches decussate, all many-cleft. *Involucre* none. (De Cand.)

Biennial. *Stem* branched, about 2 feet high. *Umbels* numerous, dense. *Flowers* white or pale flesh-coloured; appear in June.

Hab.—In meadows and pastures all over Europe; naturalized in England. Largely cultivated in Essex.

DESCRIPTION.—The mericarps, commonly called *caraway seeds* (*fructus seu semina carui*) are from $1\frac{1}{2}$ to 2 lines long, usually separated, slightly curved inwards, of a brownish colour, with five lighter coloured primary ridges; there are no secondary ones. In each channel is one vitta, and on the commissure are two. The smell is

¹ Hist. Nat. lib. xix. cap. 49, ed. Valp.

² Lib. iii. cap. 66.

Fig. 351.

a. *Coriandrum sativum*.b. *Carum Carui*.

aromatic and peculiar, the taste warm and spicy. The caraway of the shops is in part the produce of this country, but is partly supplied from Germany. In 1839, duty (30s. per cwt.) was paid on 515 cwt. which were imported.

COMPOSITION.—No analysis of the fruit has been made. The aromatic qualities depend on a volatile oil. (See below.)

PHYSIOLOGICAL EFFECTS.—Caraway is an aromatic stimulant and condiment. Its effects are similar to those of dill and anise.

USES.—Caraway is principally consumed by the confectioner and cook. It is also used by the distiller for flavouring liquors. Its medicinal employment is not extensive. It is given to relieve the flatulent colic of children, and enters, as an adjuvant or corrective, into several officinal compounds. It is less seldom

employed in substance than in the form of oil, spirit, or water.

1. **OLEUM CARUI**, L. E. D. [U. S.]; *Oil of Caraway*.—(Obtained by submitting the fruit [bruised, E] to distillation with water).—The quantity obtained from a given weight of fruit is variable: Recluz says about 4.7 per cent.; but I am informed, by a manufacturing chemist, that he has obtained 213 lbs. of oil from 35 cwt. of the fruit; which is about 5.43 per cent. When fresh prepared it is colourless; but it becomes yellow and subsequently brown by keeping. It is limpid, and has the aromatic odour of the fruit and an acrid taste. Its sp. gr. is 0.950 (0.938, *P. L.*). According to Schweizer,¹ it consists of carbon 86.14, hydrogen 10.68, and oxygen 3.18. When submitted to distillation with caustic potash, it yields a carbo-hydrogen (*caruen*), whose formula is $C^{10}H^8$. The brown residue in the retort yields, when mixed with water, a brown resin and a brown alkaline solution. If the latter be saturated with an acid and distilled, an acrid oil (*caruacrol*) is obtained. Oil of caraway is generally employed in the preparation of the spirit and water. It is used to impart flavour, to correct the nauseating and griping qualities of some medicines, and to relieve flatulence. It is frequently added to cathartic pills and powders.—Dose, one to ten drops.

[2. **SPIRITUS CARUI**, L. E.; *Spirit of Caraway*.—(Oil of Caraway f3ij [Bruised Caraway lbss, E.]; Proof Spirit Cong. j [Ovij, E.]. Mix. [Water Ojss, E.] Macerate for two days in a covered vessel, E.; distil off lbvij, E., by a gentle heat. The simple solution of the oil, as recommended by the London College, is by far the best mode of preparing this and the other spirits of the Pharmacopœia.—Ed.] It is aromatic and carminative. Dose, f3j to f3iv. Sweetened with sugar, this spirit is drunk in Germany as a dram (*Kümelliqueur*; *Kumelbrandwein*).

3. **AQUA CARUI**, L. D.; *Caraway Water*.—(Caraway Oil f3ij; Powdered Flint 3ij; Distilled Water Cong. j. Beat up the oil thoroughly first with the flint, afterwards with the water, and filter the liquor, L. Essence of Caraway 3j; Distilled Water 3ix. Mix with agitation, and filter through paper, D.)—This water is employed as a carminative vehicle for purgatives (as saline purgatives, magnesia, &c.) and in the flatulent colic of children.

¹ *Pharmaceutisches Central-Blatt für 1841*, S. 789.

237. PIMPINELLA ANISUM, Linn.—THE ANISE.

Ses. Syst. Pentandria, Digynia.
(Fructus, L.—Fruit, E.—Semina, D.)

HISTORY.—Anise was used by Hippocrates.¹ It is also mentioned by Pliny² and Dioscorides.³ The latter terms it *άνισον*. It was introduced into this country in 1551. In our translation of the New Testament,⁴ the word *anise* occurs instead of *dill*.

BOTANY. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* obovate, emarginate, with an inflexed lobe. *Fruit* contracted at the side, ovate, crowned by a cushion-like disk, and reflexed, somewhat capitate styles. *Mericarps* [half-fruits] with five filiform, equal ridges, the lateral ones being marginal. *Channels* multivittate, with a bifid free carpophorus. *Seed* gibbous convex, anteriorly flattish. *Roots* simple, radical *leaves* pinnatisect; the segments roundish, toothed, rarely undivided; those of the stem more finely cut. *Umbels* of many rays. *Involucre* none. *Petals* white, rarely pink or yellow. (De Cand.)

Sp. Char.—*Stem* smooth. Radical *leaves* cordate, somewhat roundish, lobed, incised, serrate; middle ones pinnate lobed, the lobes cuneate or lanceolate; the upper ones trifid, undivided, linear. *Fruit* bearing a few scattered hairs. (De Cand.)

Root tapering. *Stem* erect, branched, about a foot high. *Flowers* small, white.

Hab.—Island of Scio and Egypt. Largely cultivated for its fruit in Malta, Spain, and various parts of Germany. It also grows in Asia.

DESCRIPTION.—The fruit, called *aniseed* (*fructus seu semina anisi*), is slightly compressed at the sides. The separated mericarps are ovate, of a grayish-green colour, with five paler, thin, filiform, primary ridges (there are no secondary ones), and covered with downy hairs. In each channel are three vittæ. The odour is aromatic, and similar to that of the fruit of *Illicium anisatum*, or *star anise*, a plant belonging to the family Winteraceæ. The taste is sweetish and aromatic. By careless observers, aniseed may be confounded with the fruit of hemlock.

COMMERCE.—Aniseed is principally imported from Alicant and Germany (the first is preferred); but some is also brought from the East Indies. In 1839, duty (5s. per cwt.) was paid on 192 cwt.

COMPOSITION.—A very elaborate analysis of the fruit was made by Brandes and Reimann in 1826.⁵ The following are their results: Volatile oil 3.00, stearin combined with chlorophylle 0.12, resin 0.58, fatty oil soluble in alcohol 3.38, phytoeol 7.85, incrustallizable sugar 0.65, gum 6.50, extractive 0.50, substance analogous to ulmin (Anis-ulmin) 8.60, gumoin 2.90, lignin 32.85, salts (acetate, malate, phosphate, and sulphate) of lime and potash 8.17, inorganic salts, with silicic acid and oxide of iron 3.55, water 23.00 (excess 1.65).

OIL OF ANISE (see p. 704).

PHYSIOLOGICAL EFFECTS.—Anise is an aromatic stimulant. Its effects are similar to those of dill. The odour of anise is said to be recognized in the milk of those who have taken it; moreover, the urine, we are told, acquires an unpleasant smell from it; hence it would appear that the oil of anise becomes absorbed. It has been supposed to promote the secretion of milk, urine, bronchial mucus, and of the menses, though without sufficient evidence. Vogel⁶ says that he accidentally discovered that pigeons are readily killed by a few drops of the oleum anisi. Hilletfield⁷ also notices its poisonous operation on pigeons.

¹ Pp. 263, 265, &c. ed. Fœs.

² L. b. iii. cap. 65.

³ *Concin.* *Handb. d. Chem.* ii. 1277.

⁴ Wilmier, *Wirk. d. Arzneien*. Bd. ix. S. 207.

⁵ *Hist. Nat. lib. xx. cap. 72*, ed. Valp.

⁶ *Matth.* xxi. i. 23.

⁷ *Hist. Nat. Med.* 161.

USES.—Anise is used to flavour liqueurs, sweetmeats, confectionery of various kinds, ragouts, &c.

In medicine, it is employed to relieve flatulence and colicky pains, especially of children, and to prevent the griping effects of some cathartics. Nurses sometimes take it to promote the secretion of milk. It has also been employed in pulmonary affections. It is used as a horse medicine.

1. *OLEUM ANISI*, L. E. D. [U. S.]; *Oil of Anise*.—(Obtained by submitting the fruit with water to distillation.)—Mr. Brande says, that from one cwt. of fruit about two pounds of oil are obtained. The greater part of the oil consumed in this country is foreign. The oil of anise of the shops is imported into this country from Germany and the East Indies. In 1839, duty (1s. 4d. per lb.) was paid on 1544 lbs. It is procured, by distillation, from the fruit, in whose pericarp it resides. When carefully prepared it is transparent and nearly colourless, having a slightly yellow tinge. It has the odour and taste of the fruit from which it is obtained. Its specific gravity increases with its age; thus Martius says that, when the oil is fresh distilled, the specific gravity is only 0.979; but after keeping it for a year and a half, the specific gravity has increased to 0.9853. It congeals at 50° F., and does not liquefy again under 62°. It is soluble in all proportions in alcohol; but spirit whose specific gravity is 0.84, dissolves only 0.42 of its weight. By exposure to the air it forms resin, and becomes less disposed to congeal. It is composed of two volatile oils, one solid at ordinary temperatures (*stearoptène*); the other liquid (*eleoptène*), in the following proportions: *eleoptène* 75, *stearoptène* 25. According to Cahours, the *stearoptène* consists of $C^{20}H^{32}O^2$.

The *oleum badiani*, or the *oil of star-anise* (*Illicium anisatum*), has the odour and taste of the oil of anise; but it preserves its fluidity at 35.6 F. It is sometimes fraudulently substituted for the *oleum anisi*.

ADULTERATIONS.—Spermaceti, which is said to be sometimes added to oil of anise, to promote its solidification, may be distinguished by its insolubility in cold alcohol. Camphor, said to be added for the same purpose, is recognized by its odour.—Dose, five to fifteen drops on sugar, or rubbed up with sugar in camphor mixture.

2. *SPIRITUS ANISI*, L.; *Spirit of Anise*.—(Oil of Anise fʒiij; Proof Spirit Cong. j. Dissolve.)—Stimulant, stomachic, and carminative. Dr. Montgomery¹ says that the preparation under this name, formerly in the Dublin Pharmacopœia, had nearly the composition of the Irish *Usquebaugh*, which is coloured yellow by saffron, or green by sap-green. A spirit of anise, sweetened with sugar, is sold by the liqueur dealers. A somewhat similar compound is prepared in France, under the name of *crème d'anise*.—Dose, fʒj to fʒiv.

3. *AQUA ANISI*, D.; *Anise Water*.—(Extemporaneously made by diffusing the oil through water by the aid of sugar or spirit; or, according to the Dublin formula, by mixing ʒj of the oil with half a gallon of water, and filtering.)—Employed to relieve flatulent colic of infants, and as a vehicle for other medicines.

238. FENICULUM VULGARE, Gært.—COMMON FENNEL.

Feniculum officinale, E.

Sex. Syst. Pentandria Monogynia.

HISTORY.—Fennel (*μάραθρον*) was used by Hippocrates.² Some botanists (e. g. Matthioli) have been of opinion that the *μάραθρον* of Dioscorides³ is *sweet fennel* (*Feniculum dulce*, De Cand.), and that the *ἰππομάραθρον* of the same authority⁴ is *common fennel* (*Feniculum vulgare*, De Cand.); but the latter part of the opinion from an observation of Bauhin,⁵ does not appear probable.⁶

¹ *Observ. on the Dubl. Pharm.*

² *Lib. iii. cap. 81.*

³ *Prodromus*, p. 76.

² P. 551, &c. ed. Fœs.

⁴ *Lib. i. cap. 82.*

⁵ Dierbach, *Arzneim. d. Hippocr.* 191

BOTANY. Gen. Char.—Margin of the *calyx* swollen, obsolete, toothless. *Petals* roundish, entire, involute, with a squarish, blunt lobe. *Fruit* by a transverse section nearly taper. *Mericarps* [half-fruits] with five prominent bluntly-keeled ridges, of which the lateral ones are marginal, and rather broader. *Channels* univittate. *Commissure* bivittate. *Seed* nearly semiterete.—Biennial or perennial herbs. *Stems* taper, somewhat striated, branched. *Leaves* pinnatisect, decomposed; the segments linear, setaceous. *Involucre* scarcely any. *Flowers* yellow. (De Cand.)

Sp. Char.—*Stem* somewhat terete at the base. Lobes of the *leaves* linear, subulate, elongated. *Umbels* of 13 to 20 rays. *Involucre* none. (De Cand.)

A biennial, three or four feet high. *Flowers* golden yellow. *Fruit* scarcely two lines long, oval, of a dark or blackish aspect; the channel is brownish, owing to the vitta, the ridges are pale-yellowish gray.

Hab.—Sandy and chalky ground all over Europe.

DESCRIPTION—The fruit, called *wild fennel seed* (*semina seu fructus fœniculi vulgaris*) has a strong aromatic, acrid taste, and an aromatic odour. Its other qualities have been described.

COMPOSITION.—The peculiar properties of the fruit depend on a volatile oil.

OIL OF COMMON, WILD, OR BITTER FENNEL (*Oleum Fœniculi vulgaris*)—A pale yellow, limpid oil, having the peculiar odour of the fruit. Its sp. gr. is 0.997. It congeals by a cold below 50°, though with much more difficulty than oil of anise. It consists of a stearoptene which has the same composition as that of oil of anise; and a liquid oil which is isomeric with oil of turpentine. [The formula of oil of fennel is $C^{20}H^{12}O^2$.—En.]

PHYSIOLOGICAL EFFECTS.—Aromatic stimulant, similar to those of sweet fennel.

USES.—This species is not employed in medicine.

239. FENICULUM DULCE, C. Bauhin; De Cand.—SWEET FENNEL.

Sez. Syst. Pentandria, Monogynia.
(Fructus, L.)

HISTORY.—This plant is regarded by some botanists as a cultivated variety of the former plant. De Candolle¹ is the principal systematic writer who regards them as distinct species.

BOTANY. Gen. Char.—See *F. vulgare*.

Sp. Char.—*Stem* somewhat compressed at the base. Radical *leaves* somewhat distichous; lobes capillary, elongated. *Umbels* of six to eight rays. (De Cand.)

This plant differs from *F. vulgare* in several other particulars. It is an annual and much smaller plant. It flowers earlier. Its turiones are sweeter, less aromatic, and therefore edible. The fruit is much longer; some of the specimens being nearly five lines in length, less compressed, somewhat curved and paler, with a greenish tinge.

Hab.—Italy, Portugal, &c. Cultivated as a pot-herb, and for garnishing.

DESCRIPTION.—The fruit, termed *sweet fennel seeds* (*fructus seu semina fœniculi dulcis vel fœniculi cretici*), has a more agreeable odour and flavour than common or wild fennel. Two kinds are known in trade, *shorts* and *longs*; the latter is most esteemed.

COMPOSITION.—The peculiar properties of the fruit depend on a volatile oil.

PHYSIOLOGICAL EFFECTS.—Sweet fennel is an aromatic stimulant; its effects are similar to those of anise or dill.

USES.—Seldom employed. May be given in the flatulent colic of children, or as a carminative vehicle for remedies which are apt to gripe.

1. OLEUM FENICULI, L. E. D. [U. S.]; Oil of Sweet Fennel; Oleum Fœniculi dulcis.—(Obtained by submitting the fruit [bruised, E.] with water to distillation.)

¹ Prodr. iv. 142.

—Nineteen cwt. of the fruit (*shorts*) yield 78 lbs. of oil.¹ This oil is distinguished from the oil of wild fennel by its more agreeable odour and taste. Stimulant and carminative. Seldom used.—Dose, two to twenty drops.

2. **AQUA FENICULI**, E. D. [U. S.]; *Fennel Water*.—(Obtained like *Aqua Anethi*, see p. 707.)—Carminative. Employed to relieve flatulent colic of infants, and as a vehicle for other medicines.—Dose, for an adult fʒj to fʒiij; for an infant fʒj to fʒij.

240. ANETHUM GRAVEOLENS, Linn.—COMMON GARDEN DILL.

Sex. Syst. Pentandria, Digynia.

(*Fructus*, L.—Fruit, E.)

HISTORY.—This plant is mentioned by Hippocrates,² by Dioscorides,³ and by Pliny.⁴ It is also noticed in the New Testament.⁵

BOTANY. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* roundish, entire, involute, with a squarish retuse lobe. *Fruit* lenticular, flattened from the back, surrounded by a flattened border. *Mericarps* [half-fruits] with equidistant, filiform ridges; the three intermediate [dorsal] acutely keeled, the two lateral more obsolete, losing themselves in the border. *Vittæ* broad, solitary in the channels, the whole of which they fill, two on the commissure. *Seeds* slightly convex, flat in front. Smooth erect *annuals*. *Leaves* decomposed, with setaceous linear lobes. *Involucres* and *involucellæ* none. *Flowers* yellow. (De Cand.)

Sp. Char.—*Fruit* elliptical, surrounded with flat dilated margin. (De Cand.)

Root tapering long. *Stem* one and a half to two feet high, finely striated, simply branched. *Leaves* tripinnated; segments fine capillary; leaf-stalks broad and sheathing at the base. The plant greatly resembles common fennel, though its odour is less agreeable.

Hab.—South of Europe, Astrachan, Egypt, Cape of Good Hope, Timor, &c. Probably migratory. Cultivated in England.

DESCRIPTION.—The fruit, commonly called *dill seed* (*fructus seu semina anethi*), is oval, flat, dorsally compressed, about a line and a half long, and from a half to one line broad, brown and surrounded by a lighter-coloured membranous margin (*ala*). Each mericarp (or half-fruit) has five primary ridges, but no secondary ones. In each channel is one vitta, and on the commissure are two vittæ. These vittæ contain the aromatic oil. The odour of the fruit is strongly aromatic; the taste warm and pungent.

COMPOSITION.—Dill owes its peculiar properties to a volatile oil. (See below.)

PHYSIOLOGICAL EFFECTS.—Aromatic stimulant, carminative and condimentary, analogous to other aromatic umbelliferous fruits.

USES.—Employed as a condiment by the Cossacks. Loudon⁶ says the leaves “are used to heighten the relish of some vegetable pickles, particularly cucumbers; and also occasionally in soups and pickles.”

In medicine, it is principally employed in the diseases of children. It is a common domestic remedy among nurses, to relieve flatulence and griping of infants. Occasionally, it is taken under the idea of its promoting the secretion of milk. Practitioners generally use dill as a vehicle for the exhibition of purgative and other medicines to children, the griping of which it assists in preventing. The whole fruits may be given to adults in doses of ten grains to a drachm.

1. **OLEUM ANETHI**, L. [U. S.]; *Oil of Dill*.—(Obtained by submitting the bruised fruit of dill, with water, to distillation.)—Two cwt. of the fruit yield 8lbs. 5 ozs. of oil.⁷ This oil is pale yellow. Its sp. gr. is 0.881. Its odour is peculiar and

¹ Private information.

² Lib. iii. cap. 67.

³ *Matt.* xxiii 23.

⁷ Private information.

² *Opera*, p. 359, ed. Foss.

⁴ *Hist. Nat. lib.* xx. cap. 74, ed. Vulp.

⁶ *Encyclopædia of Gardening*.

penetrating, analogous to that of the fruit. Its taste is hot, but sweetish. Alcohol and ether readily dissolve it. According to Tietzmann, 1440 parts of water dissolve one part of this oil. Principally used to prepare dill water. May be taken in the dose of a few drops on sugar, or dissolved in spirit.

2. *AQUA ANETHI*, L. E.; *Dill Water*.—(Dill, bruised, lb. iss. [℥xviiij , E.]; Rectified Spirit ℥iij , E.; Water, Cong. ij. Mix. Let a gallon distil. [*Vel*, Oil of Dill ℥ij ; Powdered flint ℥ij ; Distilled Water Cong. j. Beat up the oil carefully first with the flint, afterwards with the water, and strain the liquor. According to the London Pharmacopœia, it may be made like the *Aqua Carui*, by triturating the oil with powdered flint and filtering through paper.—ED.]—Carminative. Dose, for adults ℥j to ℥iij ; for infants ℥j to ℥iij . It is generally given to infants with their food.

241. CUMINUM CYMINUM, Linn.—THE OFFICIAL CUMIN.

Sex. Syst. Pentandria, Digynia.

(Fructus, L.—Fruit, E.)

HISTORY.—This plant is mentioned in both the Old and New Testament,¹ and by Hippocrates,² Dioscorides,³ and Pliny.⁴ The Greeks call it *κύμινον ἡμέρον* vel *αἰθιονίζον*.

BOTANY. *Gen. Char.*—Teeth of the *calyx* 5, lanceolate, setaceous, unequal, persistent. *Petals* oblong, emarginate, erect, spreading, with an inflexed lobe. *Fruit* contracted at the side. *Mericarps* [half-fruits] with wingless ridges; the primary ones 5, filiform, minutely muricated, the laterals forming a border; the secondary ones 4, more prominent, and aculeate. *Channels* under the secondary ridges 1-vittate. *Carpophorus* bipartite. *Seed* somewhat concave anteriorly, on the back convex.—*Herbs.* *Leaves* many-cleft; lobes linear, setaceous. *Leaflets* of the *involute* 2 to 4, simple or divided. *Involucellum* halved, 2- to 4-leaved, becoming reflexed. *Flowers* white or pink. (De Cand.)

Sp. Char.—Lobes of the *leaves* linear, setaceous, acute. *Umbel* 3- to 5-cleft. *Partial involucre* equalling the pubescent fruit. (De Cand.)

Root annual. *Stem* slender, branched, about a foot high. *Leaves* filiform. *Flowers* white or reddish.

Hab.—Upper Egypt, Ethiopia. Extensively cultivated in Sicily and Malta.

DESCRIPTION.—The fruit, commonly termed *cumin seeds* (*fructus seu semina cumini*), is larger than anise, and of a light-brown or grayish-yellow colour. It has some resemblance to, though it is larger than, caraway. Each mericarp has five primary ridges, which are filiform, and furnished with very fine prickles. The four secondary ridges are prominent and prickly. Under each of these is one vitta. The odour of the fruit is strong and aromatic. Both odour and taste are somewhat analogous to, but less agreeable than, caraway. Cumin is imported from Sicily and Malta. In 1839, duty (2s. per cwt.) was paid on 53 cwt.

COMPOSITION.—The peculiar properties of cumin reside in a volatile oil.

OIL OF CUMIN; *Oleum Cumini*.—Obtained by submitting the fruit to distillation with water. Sixteen cwt. of the fruit yielded about 44 lbs. of oil. This oil, as usually met with, is pale-yellow and limpid. Its smell is disagreeable; its taste very acrid. It consists of two oils, one a carbon-hydrogen, called *Cumen* or *Cymen*, $\text{C}^{18}\text{H}^{24}$; the other an oxygenated oil called *Hydruret of Cumyl*, $\text{C}^{20}\text{H}^{11}\text{O}^2 + \text{H}$. *Cumyl* is an hypothetical base composed of $\text{C}^{20}\text{H}^{11}\text{O}^2$. When treated with caustic potash, oil of cumin yields *hydrated cuminic acid*, $\text{C}^{20}\text{H}^{11}\text{O}^3 + \text{Aq}$. This is a crystallizable solid.

PHYSIOLOGICAL EFFECTS.—Cumin agrees with the other aromatic umbelliferous fruits in its mildly stimulant and carminative qualities.

¹ *Israh* xxv. i. 27; *Matthew* xxiii. 23.

² *Lib* iii. cap. 65.

³ *Opera*, 407, &c. ed. Pers.

⁴ *Hist. Nat.* lib. xix. cap. 47, ed. Valp.

USES.—Internally, cumin is rarely used; caraway being an equally efficient and a much more agreeable medicine. As a discutient and resolvent, it is employed, externally, in the form of *plaster* (*Emplastrum cumini*, Ph. L. 1824) and *cataplasma* (*cataplasma e cymino*, Quincy). In the recent London Pharmacopœia, the *Emplastrum Cumini* has been restored. The dose of Cumin seeds is grs. xv to ʒss. It is principally used in veterinary surgery.

[**EMPLASTRUM CUMINI**, L.—(Cumin, Caraway, Laurel, each ʒij; Prepared Burgundy Pitch lbs. iij; Wax ʒij; Olive Oil, Water, each fʒiss. Add the oil and water to the pitch and wax, melted together and powdered dry, then evaporate to a proper consistence.)—This preparation was excluded from the Ph. L. of 1836, but is now restored.—ED.]

242. CORIANDRUM SATIVUM, Linn.—THE OFFICINAL CORIANDER.

Sex. Syst. Pentandria, Digynia.

(Fructus, L.—Fruit, E.—Semina, D.)

HISTORY.—Coriander is mentioned by Moses.¹ It was used by Hippocrates.² Dioscorides³ and Pliny⁴ also mention it. The Greeks called it *κόριον* or *κορίαννον*.

BOTANY.—**Gen. Char.**—Teeth of the *calyx* 5, acute, unequal, persistent. *Petals* obovate, emarginate, with an inflexed lobe, the exterior radiating, bifid. *Fruit* globose, 10-ribbed, scarcely separating. *Mericarps* [half-fruits] with five primary, depressed, wavy ridges, and four secondary ones [besides the marginals] more prominent and keeled. *Channels* evittate. *Commissure* bivittate. *Carpopodium* in the middle face, semi-bifid, adnate at the base and apex. *Seed* excavated in the front, covered with a loose membrane.—Smooth *herbs*. *Stem* round. *Leaves* (upper ones at least) many-cleft. *Umbel* with three to five rays. *Involute* none. *Involutella* about 3-leaved, halved. *Flower-bud* sometimes roseate. *Flowers* white. *Stylopodium* conical. (De Cand.)

Sp. Char.—The only species.

Root tapering. *Stem* erect, twelve to eighteen inches high. *Leaves* scarcely stalked, all bipinnate and cut; the *leaflets* of some of the lowermost wedge-shaped or fan-shaped; acute notched; of the rest, in fine, linear segments. *Flowers* white, often with a reddish tint.

Hab.—Grows wild about Ipswich and some parts of Essex, but is not really indigenous. Native of the South of Europe. Cultivated in Essex.

DESCRIPTION.—The fruit, commonly termed *coriander seeds* (*fructus seu semina coriandri*), is globular, about the size of white pepper, of a grayish-yellow colour, and is finely ribbed. It consists of two hemispherical mericarps, adherent by their concave surfaces. Each mericarp has five primary ridges, which are depressed and wavy; and four secondary ridges, more prominent and carinate. The channels are without vittæ, but the commissure has two. The odour of coriander is peculiar and aromatic.

COMPOSITION.—The odour, taste, and medicinal qualities of the fruit depend on volatile oil.

VOLATILE OIL OF CORIANDER (*Oleum Coriandri*).—Yellowish; smells strongly and prettily agreeably of the coriander.

PHYSIOLOGICAL EFFECTS.—Aromatic stimulant, like the other carminative umbelliferous fruits.

USES.—Dr. Cullen considered coriander as more powerfully correcting the odour and taste of senna than any other aromatic; and hence, it was formerly a constituent of the compound infusion of senna, though now ginger is substituted for it.

¹ *Erod.* xvi. 31.

² *Lib.* iii. cap. 71.

² *Opera*, 359, 529, &c. ed. Fœs.

⁴ *Hist. Nat.* lib. xx. cap. 82, ed. Valp.

It is only employed in medicine as an adjuvant or corrigent. It is used, however, by the confectioners and distillers. It is a constituent of the *Confectio sennæ*.—The dose of coriander is ʒss to ʒj.

2. UMBELLIFEROUS ROOTS USED IN MEDICINE.

There are only two umbelliferous roots used in medicine and introduced into the Pharmacopœia. These are, *Angelica* and *Carrot*. Both contain a volatile oil.

243. ARCHANGELICA OFFICINALIS, Hoffm. and Koch.— GARDEN ANGELICA.

Angelica Archangelica, Linn. E. D.

Sex. Syst. Pentandria, Digynia.

(Root, E.—Semina, D.)

HISTORY.—It is doubtful whether the ancient Greeks and Romans were acquainted with this plant, as no certain notice of it appears in their writings. C. Bauhin¹ calls it *Angelica sativa*.

BOTANY. **Gen. Char.**—Margin of the *calyx* with 5 short teeth. *Petals* elliptical, entire, acuminate, with the point curved inwards. *Fruit* somewhat compressed at the back, with a somewhat central raphé, 2-winged on each side. *Mericarps* [half-fruits] with thick, keeled ridges; the three dorsal ones elevated, the two lateral ones dilated into a twice as broad wing. *Seed* not adhering to the integument; the nucleus free, covered all over with numerous vittæ. *Carpophorus* 2-partite.—Perennial *herbs*. *Leaves* pinnatisect; segments broadly ovate, acute, coarsely dentate, terminal, lobed. *Petioles* large, sheathing, saccate. *Involucre* scarcely any; *partial one* halved, many-leaved. *Flowers* white, or greenish. (De Cand.)

Sp. Char.—*Stem* smooth, terete, striated. *Leaves* bipinnatisect; segments subcordate, lobed, sharply serrated, the odd one 3-lobed; sheaths loose, saccate. Leaflets of the *partial involucre* equalling the partial umbel. (De Cand.)

Root biennial, large, fleshy, branched, resinous, pungently aromatic. *Stem* four or five feet high, a little glaucous. *Foliage, stalks, and even the flowers*, bright green. It flowers from June to September.

Hab.—Indigenous; northern parts of Europe. Cultivated in moist situations, and on the banks of ditches.

DESCRIPTION.—The dried angelica root (*radix angelicæ*) of the shops is imported from Hamburg in casks. In 1839, duty (4s. per cwt.) was paid on 386 cwts. Formerly, *Spanish angelica* was alone employed for medicinal purposes. The dried root of the shops consists of a short cylindrical head, from which numerous branches arise. The size of these branches varies; the larger ones are as thick as the little finger, and six or eight inches long. Externally, the root is corrugated, and grayish brown. Internally, it is dirty white, and presents, when cut transversely, numerous dark points, which are the cut extremities of vessels or intercellular spaces filled with a liquid, strongly odorous oil, or oleo-resin. To the taste, the root is at first sweet, then hot, aromatic, and bitter. The odour is peculiar, and not very disagreeable. The fruit, called *angelica seeds* (*fructus seu semina angelicæ*), have the odour and taste, but in a diminished degree, of the root.

COMPOSITION.—Angelica root has been analyzed by John,² and by Bucholz and Brandes. The latter chemists obtained *volatile oil* about 0.70, *acid soft resin* 6.02, *bitter extractive* 26.40, *gum* with some common salt 31.75, *starch* (not inulin) 5.40, *woody fibre* 8.60, *peculiar matter* (oxidized extractive)? 0.66, *albumen* 0.97,

¹ Pinax, 155.

² Gmelin, *Handb. d. Chem.* ii. 1277.

water 17.50 [loss 2.0]. The aromatic qualities of the root and seeds depend on the volatile oil and resin.

PHYSIOLOGICAL EFFECTS.—Both root and seeds are pungent aromatic stimulants and mild tonics.

USES.—Angelica (either root or seeds) is scarcely employed in modern practice, though it was formerly much esteemed. The tender stems, stalks, and midribs of the leaves are made, with sugar, into a sweetmeat or candy (*candied angelica*; *caules seu rami angelicæ conditi*), which, taken as a dessert, is a very agreeable stomachic. The seeds were formerly used in the preparation of the *Spiritus anisi compositus* of the Dublin Pharmacopœia. The principal consumption of angelica root and seeds is by rectifiers and compounders in the preparation of gin and the liqueur termed *bitters*.

224. DAUCUS CAROTA (var. SATIVA), Linn.—COMMON OR WILD CARROT.

Sez. Syst. Pentandria, Digynia.

(Fructus; Radix recens, L.—Radix, D.)

D. Carota var. *sativa*, De Candolle, E. (Root.)

D. Carota var. *sylvestris*, D. (Semina.)

HISTORY.—According to Dr. Sibthorp,¹ this plant is the *σαφνλινος* of Dioscorides.² Hippocrates³ employed it in medicine under the same name. The *σαφνλινος ἀγριος* of Dioscorides is, according to Dr. Sibthorp, the *Daucus guttatus*.

BOTANY. Gen. Char.—Margin of the *calyx* 5-toothed. *Petals* obovate, emarginate, with an inflexed point; the outer generally radiating, and deeply bifid. *Fruits* somewhat compressed from the back, ovate or oblong. *Mericarps* [half-fruits] with the five primary ridges filiform and bristly; the three middle ones at the back; the two laterals on the plane of the commissure; the four secondary ridges equal, more prominent, winged, split into a simple row of spines. *Channels* beneath the secondary ridges 1-vittate. *Seed* anteriorly flattish.—Usually biennial herbs. *Leaves* bipinnatisect. *Involucre* of many, tri-, or pinnatifid leaflets; partial involucre of many, entire, or trifid leaflets. *Flowers* white or yellow; the central generally fleshy, blackish purple, sterile. (De Cand.)

Sp. Char.—*Stem* hispid. *Leaves* 2- or 3-pinnatisect; the segments pinnatifid; the lobes lanceolate, cuspidate, almost equal to the umbel. *Prickles* equal to the diameter of the oblong-oval fruit. (De Cand.)

Root slender, yellowish, aromatic, and sweetish. *Stem* two or three feet high, branched, erect, leafy, hairy, or bristly. *Leaves* on broad, concave, ribbed footstalks, distinctly hairy. *Umbels* large, white, except the one central neutral flower, which is blood-red. *Fruit* small, protected by the incurvation of the flower-stalks, by which the umbels are rendered hollow, like a bird's nest (condensed from Smith).

Hab.—Indigenous; in pastures and the borders of fields, in a gravelly soil, common. Europe, Crimea, and the Caucasus; from thence, probably, carried to China, Cochin-China, and America.

Daucus Carota var. *sativa*, DC, E.; Cultivated or Garden Carrot.—This has a thick succulent root, whose colour varies. Loudon mentions ten garden varieties.

DESCRIPTION.—The officinal root is that of the cultivated plant (*radix dauci sativi*). It is tap-shaped, now and then branched, reddish, or pale straw-coloured, succulent, of a peculiar, not unpleasant odour, and a sweet, mucilaginous, agreeable taste. *Carrot juice* (*rob dauci*) is reddish, turbid, with the odour and taste of the root. By standing, a feculent matter (*amylum dauci*), which has been recently employed in medicine, is deposited.⁴ It coagulates at a temperature under 212° F. The coagulum is yellow, and when dried amounts to 0.629 of the juice. The root

¹ Prodr. Fl. Græc. i. 183.

² Page 686, ed. Fœs.

³ Lib. iii. cap. 59.

⁴ Pharm. Central-Blatt für 1841, p. 204.

of the wild or uncultivated carrot is small, woody, acrid, and bitter, with a strong aromatic odour.

The official *fruits*, usually called *carrot seeds* (*fructus seu semina dauci sylvestris*), are those of the wild carrot; they are brownish, from one to one and a half lines long, with a peculiar and aromatic odour, and a bitter and warm taste. Their other characters have been already described. The seeds of the cultivated carrot are much milder.

COMPOSITION.—The *fruit* (commonly termed *seeds*) has not been analyzed; the seeds owe their peculiar properties to volatile oil (*oleum seminum dauci sylvestris*). The *root* has been analyzed by Vauquelin,¹ by Wackenroder,² and by C. Sprengel.³ The constituents of the expressed juice, evaporated to dryness, are, according to Wackenroder, *fixed oil with some volatile oil* 1.0, *carotin* 0.34, *uncrystallizable sugar with some starch and malic acid* 93.71, *albumen* 4.35, *ashes* composed of alumina, lime, and iron 0.60.

1. VOLATILE OIL OF CARROT TREE.—Colourless, has a smell of carrots, a strong, permanent, unpleasant taste, and a sp. gr. of 0.8863 at 54° F. It is little soluble in water, but very soluble in alcohol and ether. From 34 lbs. of the fresh root only half a drachm of oil was obtained. It is probable that the *volatile oil of carrot-fruits* possesses analogous properties.

2. CAROTIN.—A crystalline, ruby red, tasteless, odourless, neutral substance. It is fusible and combustible, but not volatile, soluble in the mixed and volatile oils, slightly so in alcohol, not in ether, unless fat oil be present. Its solutions are decolorized by solar light.

3. PECTIC ACID.—By the action of alkalis on the ligneous tissue of carrots, Braconnot procured *pectic acid*. I have repeated his experiments, and can confirm his statements, but the quantity obtained is small. Pectic acid consists, according to Frény, of $C^{21}H^{17}O^{22}$.

PHYSIOLOGICAL EFFECTS AND USES.—The *fruit* (*seed* of the shops) of the carrot is an aromatic stimulant and carminative, like the other aromatic umbelliferous fruits. Aretæus says it possesses diuretic properties, a statement confirmed by Eberle.⁴ It has been employed in suppressions of urine and painful micturition, and also in dropsies. The *expressed juice* has been used as an anthelmintic.

The boiled *root* is a well-known article of food. Raw scraped carrot is sometimes applied to chapped nipples; it is a stimulant, and occasionally proves a painful application. Boiled carrots are only employed in the form of poultice⁵ to ill-conditioned sloughing sores.⁶

3. UMBELLIFEROUS FETID GUM-RESINS.

These are solid compounds, essentially composed of *resin*, *gum*, and *volatile oil*. The most important are *Assafœtida*, *Galbanum*, *Ammoniacum*, *Sagapenum*, and *Opoponax*.

They are obtained from the roots and stems of umbelliferous plants growing in eastern countries, Persia especially. By distillation with water they yield a *volatile oil*. This oil, at least in the case of assafœtida, is sulphuretted. It is remarkable that many of the strong-smelling fetid volatile oils (as garlic, mustard, &c.) also contain sulphur. The action of alcohol and water upon these gum-resins may be thus generally stated: *Alcohol* dissolves the *oil* and the *resin*, and leaves the *gum*. Water, subsequently added to the alcoholic liquid, precipitates the resin.

Water dissolves the *gum*, and suspends the *oil* and *resin*, forming a milky mixture.

We are in want of good means of distinguishing the different gum resins, chemically. Their peculiar odours at present enable us to distinguish them. In some cases, odours become particularly distinctive by heat, as in the case of *ammoniacum*. The gum-resin of *assafœtida* is reddened by light.

¹ *Ann. de Chim. et Phys.* xli. 46.

² *Pharm. Central-Blatt für* 1832, p. 443.

³ For further details respecting the medicinal uses of the carrot, see Bridault, *Traité sur la Carotte, et Recueil d'Observations sur l'Usage et les effets salutaires de cette Plante dans les Maladies externes et internes*. Svo. Rochelle, An. xl.

⁴ *Med. Observ. and Inq.* vol. iv. pp. 144-191, and 458.

⁵ Gmelin, *Handb. de Chem.* ii. 1277.

⁶ *Mat. Med.* 2d edit ii. 260.

245. NARTHEX (*Ferula*) ASSAFŒTIDA (*Falconer*).—THE ASSAFŒTIDA FERULA.

Sex. Syst. Pentandria, Digynia.

(Gummi-resina, *L. D.*—Gummi-resinous exudation, *E.*) -

[Assafœtida, *U. S.*]

HISTORY.—It is uncertain at what period assafœtida was first known or described. The difficulty in determining its history arises from the confusion which has existed with respect to the *Succus Cyrenæicus* and assafœtida. By many writers the two substances were considered to be identical;¹ but this opinion seems now to have been satisfactorily disproved by the discovery of the plant, called by the Greeks *σέλφιων*, by the Romans *laserpitium* (*Thapsia Silphion*, Viviani), which yields the Cyrenaic juice, and which agrees tolerably well with the rude figures struck on the Cyrenaic coins.² It would appear, however, that the Cyrenaic juice becoming scarce, the ancients employed some other substance, of similar though inferior properties, as a substitute, and to both of these they applied the term *laser*. "For many years," says Pliny,³ "this plant [laserpitium or silphion] has not been found in Cyrenaica, because the publicans [or farmers of the taxes] who rent the pastures, finding it more profitable, destroy it, as food for cattle. One stalk only, found in our days, was sent to the Emperor Nero. We may know when cattle meet with young shoots of it, by the sleeping of the sheep when they have eaten it, and the sneezing of the goats. For a long time past the only *laser* brought to us is that which is produced abundantly in Persia, Media, and America; but it is far inferior to the Cyrenaic." It is not at all improbable that the *laser of Persia* may have been our assafœtida. The word "assafœtida," says Murray,⁴ "seems to have been introduced by the Monks into the school of Salerno." But it appears to have been of oriental origin, and may be, as some have suspected, derived from the word *laser*. Nicolaus Myrepsus,⁵ almost the last of the Greek physicians, and who lived, according to Sprengel,⁶ about 1227, A. D., speaks of *ασαφιτιδα*. "There are two kinds of *Assa* [i. e. *laser*, Lat. trans.]," says Avicenna,⁷ "one *fetid*, the other *odoriferous*."⁸

BOTANY. Gen. Char.—*Umbels* compound. *Involucres* 0. *Calyx* obsolete. *Fruit* thin, compressed at the back, with a dilated border. *Ridgcs* 3 only, dorsal. *Vittæ* 1 to each dorsal furrow and 2 to the laterals. *Albumen* thin, flat.

Sp. Char.—Assafœtida (*Falconer*). Radical *leaves* 3-parted; segments bipinnatifid, with oblong-lanceolate, obtuse, decurrent lobes.

Hab.—Saristan, Affghanistan, the Punjaub.

Root perennial, tapering, ponderous, increasing to the size of a man's arm or leg, covered with a blackish-coloured bark, beset near the top with many strong, rigid fibres; its internal substance white, fleshy, abounding with a thick, milky juice, which has an excessively strong, fetid, alliacious smell. *Stem* two or three yards high or more, six or seven inches in circumference at the base, smooth. Radical *leaves* nearly two feet long. Kæmpfer⁹ compares their shape to the leaves of *Pæonia officinalis*; but in colour, and other respects, he says they resemble *Ligusticum Levisticum*, or *Lovage*. The *fruit* is flat, thin, reddish-brown, like that of parsnip, only rather larger and darker (Kæmpfer).

¹ See Geoffroy, *Tract. de Mat. Med.* ii. 609.

² *Penny Cyclopædia*, vol. viii. p. 265; and Lindley, *Fl. Med.* ii. 52.

³ *Hist. Nat. lib.* xix. cap. 15, ed. Valp.

⁴ *Antidotarius*, cap. xxvii. p. 365, quoted by Alston, *Mat. Med.* li. 438.

⁵ *Lib. 2ndus*, tr. 2ndus, cap. 53.

⁶ *App. Med.* i. 361.

⁷ *Hist. de Méd.* iv. 365.

⁸ The word *ferula* is derived from *ferire*, to strike. The stalks were used as rods for children, because they made more noise than did harm (London). The term *ferula* is, in fact, an English word to designate the instrument with which scholars are beaten on the hand (Walker). The instrument is a little wooden pallet or slate (Chambers). Hence, Martial calls it the *sceptra pædagogorum*, or schoolmaster's sceptre (see Lemery).

⁹ *Aman. exot.* 535.

This is now considered to be the genuine assafætida plant; but there is reason to believe that a gum-resin, like assafætida, is obtained from other species of *ferula*.¹ *Ferula persica* has been described by Dr. Pope² as the assafætida plant; and the *Edinburgh College* has admitted it as being, probably, one source of assafætida. Michaux sent its fruit from Persia as assafætida.³ That it does really yield assafætida seems farthermore probable, from the strong smell of that drug which pervades the whole plant.⁴ It is, I think, not unlikely that the tear and lump assafætida of the shops are procured from different species. Dr. Royle⁵ suggests, that *Prangos pabularia* was one of the kinds of *Silphion* of the ancients, and may be an assafætida plant.

EXTRACTION.—Assafætida is obtained by making incisions into the upper part of the root; the footstalks of the leaves and the fibres at the top of the root being previously removed. Kämpfer divides the business of collecting into four parts; the *first* begins about the middle of April, and consists in digging the earth about the root, removing the leaves and fibres, which are afterwards laid over the root to defend it from the sun. The *second* commences on the 25th of May. Each collector is provided with a sharp knife to cut the root, a broad iron spatula to scrape

Fig. 352.



Extraction of Assafætida.

off the juice, a cup fixed to his thigh to receive it, and two baskets hung over his shoulders upon a pole. The top of the root is then cut off transversely, and, on the third day (*i. e.* the 27th of May), the juice is scraped off and put in the cups.

¹ Lindley, *Fl. Med.* pp. 45-6; and *Bot. Reg.* Aug. 1830.

² Lindley, *Fl. Med.* 46.

³ Stevenson and Church II, *Med. Bot.* iv. 169; and Nees and Ebermaier, *Handb.* ii. 55.

⁴ *Illustr.* 230.

⁵ *Phil. Trans.* vol. lxxv.

A fresh incision is then made, and the juice removed the day but one following (*i. e.* the 29th of May), when they again cut the roots. The cups are from time to time emptied into large vessels. The juice is exposed to the sun to become harder, and is conveyed home in baskets (see Fig. 352, p. 713). The *third* and *fourth* acts are mere repetitions of the second. The third commences about the 10th of June, the fourth about the 3d of July. Except after the last operation, the roots are carefully defended from the sun, after each incision, by covering them with leaves.¹

COMMERCE.—Assafœtida is exported from the Persian Gulf to Bombay, from whence it is sent to Europe. It comes over usually in casks and cases. In 1825, the quantity imported was 106,770 lbs.; in 1830, only 8,722 lbs. The quantity retained for home consumption is, however, very small. In 1838, duty (6s. per cwt.) was paid on 60 cwt.; in 1839, on 24 cwt.

DESCRIPTION AND VARIETIES.—Assafœtida (*Assafœtida*; *Gummi Assafœtida*, offic.) occurs in irregular pieces of variable size. Externally, they are yellowish or pinkish-brown. The fracture is conchoidal, whitish, or milk-white, translucent, pearly, with a waxy lustre. By exposure to light and air, the recently-fractured surface acquires, in a few hours, a violet-red or peach-blossom red colour, which after some days or weeks diminishes in intensity, and gradually passes into yellowish or pinkish-brown. Assafœtida is fusible and inflammable, burning in the air with a white flame and the evolution of much smoke. Its taste is acrid and bitter, and its odour strong, alliaceous, and peculiar; to most persons being remarkably disagreeable, whence the Germans have denominated assafœtida *Teufelsdreck*, or *Stercus Diaboli*; in plain English, *Devil's dung*. However, this dislike to the assafœtida is not universal; some of the Asiatics being exceedingly fond of it, taking it with their food as a condiment, or using it to flavor their sauces, or even eating it alone. Hence, among some of the older writers, we find it denominated *Cibus Deorum*, *Food of the Gods*. Captain M. Kinnier² tells us that, in Persia, the leaves of the plant are eaten like common greens, as is the root when roasted; and Lieut. Burnes,³ speaking of assafœtida, says, "in the fresh state it has the same abominable smell, yet our fellow-travellers greedily devoured it." But the fondness for this substance is not confined to the Asiatics; for I am assured, by an experienced gastronome, that the finest relish which a beefsteak can possess, may be communicated by rubbing the gridiron, on which the steak is to be cooked, with assafœtida.

I am acquainted with three varieties only of assafœtida:—

α. **Assafœtida in the Tear** (*Assafœtida in granis seu lacrymis*). ? *Assafœtida of the Ferula persica*.—This kind, which is comparatively rare, occurs in distinct, roundish, flattened, or oval tears, and also in irregular pieces, varying from the size of a pea to that of a walnut, of a yellow or brownish-yellow colour externally, but white internally. I think it not at all improbable that this variety is obtained from a different plant to that which furnishes the lump variety; for its colour externally is more yellow, its odour is much feebler, and its fresh-fractured surface becomes more slowly and less intensely red by exposure to the air.⁴ As it has considerable resemblance to *ammoniacum in the tear* (with which, indeed, except by its odour, it might be readily confounded), may it not be the substance which Olivier⁵ calls *ammoniacum*, and which he says is produced by *Ferula persica*?

β. **Lump Assafœtida** (*Assafœtida in massis*); *Assafœtida of the Ferula Assafœtida*.—This variety is the kind usually met with in the shops. It occurs in variable-sized masses, of irregular forms, and having a reddish or brownish-yellow colour. Frequently, these masses are observed to be made up of tears, agglutinated by a reddish-brown substance; these form that kind of assafœtida sometimes denominated *amygdaloid* (*assafœtida amygdaloides*).

¹ Kämpfer, *op. cit.*

² Ainslie, *Mat. Ind.* i. 21.

³ *Travels*, ii. 243.

⁴ [According to Guibourt, the reason why it does not become so red by exposure to air is owing to the fact that it contains less volatile oil.—Ed.]

⁵ Fée, *Hist. Nat. Pharm.* ii. 199.

γ. **Stony Assafoetida** (*Assafoetida petraea*). I have never met with this kind in English commerce. My samples were received from Dr. Martiny. It occurs in irregular, more or less angular pieces, which have the odour of assafoetida, and a yellowish-brown colour, and present numerous small shining points or plates. It slightly effervesces in hydrochloric acid. By incineration it yields a white ash, which strongly effervesces on the addition of acids. Angelini found in stony assafoetida 51.9 per cent. of gypsum.

COMPOSITION.—Assafoetida has been analyzed by Pelletier,¹ Trommsdorff, Brandes, and Angelini:²—

<i>Pelletier's Analysis.</i>		<i>Brandes's Analysis.</i>	
Resin	65.00	Resin	48.85
Gum	19.44	Gum, with traces of saline matters	19.40
Bassorin	11.66	Bassorin	6.40
Volatile oil	3.60	Volatile oil	4.60
Supermalate of lime, and loss	0.30	Extractive, with saline matters	1.40
Assafoetida	100.00	Sulphate and carbonate of lime	9.70
		Oxide of iron and alumina	0.40
		Sand and lignin	4.60
		Water	6.00
		Assafoetida	101.35

1. **VOLATILE OIL OF ASSAFŒTIDA.**—This is obtained by distilling assafoetida with either water or alcohol. It is on this principle that the odour of this gum-resin depends. It is lighter than water, and is at first colourless, but by exposure to the air acquires a yellow tinge. It dissolves in all proportions in alcohol and ether, but requires more than 2,000 times its weight of water to dissolve it. Its taste is at first mild, then bitter and acrid; its odour is very strong. It evaporates very quickly, and soon fills a large room with its odour. Sulphur, and probably phosphorus, are among its elementary constituents. The presence of sulphur in assafoetida is shown in various ways: thus, if chloride of barium be added to water distilled from assafoetida, and likewise a little chlorine, the sulphur becomes gradually acidified, and after some time a precipitate of sulphate of baryta is formed. If the oil be rubbed with mercury, it forms sulphate of mercury. Moreover, if pills made of assafoetida be rolled in silver leaf, the latter, after a few days, is blackened by the formation of a sulphuret of silver. According to Hlasiwetz, the oil is composed of two sulphurets of the hydrocarbon, $C^{12}H^{11}$, and when fresh distilled, like the essential oils of black mustard and horseradish, it contains no oxygen. It becomes acid by exposure to air, and on boiling the oil, hydrosulphuric acid is disengaged.

2. **RESIN OF ASSAFŒTIDA.**—The resinous matter of assafoetida is soluble in alcohol. When the alcoholic solution is mixed with water, a milky fluid is formed, owing to the deposition of the *hydrated resin*. Oil of turpentine and the oil of almonds also dissolve the resin, but less readily than alcohol. The resin obtained by evaporating the alcoholic solution, consists, according to Johnston, of $C^{40}H^{26}O^{10}$. By exposure to the sun's rays it becomes violet red. Brandes has shown that the resin of assafoetida is of two kinds; one insoluble in ether, the other soluble. The proportion of the first to the second is as 1.6 to 47.25.

a. *Resin insoluble in ether.*—Is brownish-yellow, brittle, tasteless, has a slight alliaceous odour, is fusible, and soluble in warm caustic potash.

B. *Resin soluble in ether.*—Is greenish-brown, brittle, has an aromatic odour, and a faint, but permanent, alliaceous bitter taste. Chlorine decolorizes it. Cold oil of vitriol renders it dark red; if heat be applied, sulphurous acid is evolved, and the mixture becomes black; if the liquid be diluted with water, and saturated with an alkali, the surface assumes a sky-blue colour. Nitric acid renders it first orange, then yellow, and makes it almost insoluble in ether. Hydrochloric acid dissolves it, and colours it pale-red. It dissolves in boiling concentrated acetic acid, but is deposited when the solution cools.

CHARACTERISTICS.—Assafoetida possesses the usual characteristics of a gum-resin. From other gum-resins it is distinguished by its peculiar odour, which is especially obvious when a small portion of this substance is heated on the point of a knife, and by its fresh-fractured surface becoming red on exposure to air. Heated with sulphuric acid it is blackened, yields a dark, blood-red liquid, and develops sulphurous acid gas; if the liquid be diluted with water, and saturated with caustic potash, it becomes blue, especially on the surface, by reflected light, similar to that observed when disulphate of quina is dissolved in water (see p. 672).

PHYSIOLOGICAL EFFECTS.—Assafoetida is usually placed, by pharmacological writers, among those remedies denominated antispasmodics or stimulants. It is the

¹ *Bull. de Pharm.* iii. 556.

² Gmelin, *Handb. de Chem.* ii. 624.

most powerful of the fetid gum-resins. Its local effects are moderate; it is devoid of those acrid and irritating properties possessed by gamboge, euphorbium, scammony, and many other resinous and gummy-resinous substances. In the mouth, as already mentioned, it causes a sensation of heat; and the same effect, accompanied by eructations, is experienced in the stomach, when it is swallowed. In Professor Jörg¹ and his pupils (males and females), who endeavoured to elucidate the effects of this medicine by experiments made on themselves, doses of assafoetida, not exceeding a scruple, caused uneasiness and pain of the stomach, increased secretion of the gastro-intestinal membrane, and alvine evacuations. The pulse was increased in frequency, the animal heat augmented, the respiration quickened, and the secretions from the bronchial membrane and skin promoted. A very constant effect was headache and giddiness. The urino-genital apparatus appeared to be specifically effected; for in the males there was an increase of the venereal feelings, with irritation about the glans penis, while in the females the catamenial discharge appeared before its usual period, and uterine pain was experienced. These stimulant effects of assafoetida were observed in a greater or less degree in all the nine persons experimented on; and it should be borne in mind that the dose did not, in any one case, exceed a scruple. Very opposite to these results, and to the observations of practitioners generally, is the statement of MM. Trousseau and Pidoux,² who tell us that they have taken half an ounce of good assafoetida at one dose, with no other effect than that of altering the odour of their secretions, by which they were kept for two days in an infected atmosphere, possessing a more horrible degree of fetidity than even assafoetida itself! These apparently contradictory results seem to prove that different individuals are most unequally susceptible of the influence of this remedy. The influence of assafoetida in convulsive and spasmodic diseases seems indisputable. As in these cases the functions of the excito-motory system are the functions principally or essentially involved, it is not assuming too much to suppose that the influence of assafoetida is principally directed to the excito-motory nerves. To paraphrase the words of Dr. M. Hall,³ assafoetida acts through the *excitor* nerves; its effects are manifested through the *motor* nerves. The varying degrees of excitability or susceptibility (natural and morbid) of these nerves in different subjects, will, perhaps, in some measure account for the unequal effects produced by this agent on different healthy individuals, as well as for the therapeutic influence in certain subjects being disproportionate to the observed physiological effects.

Assafoetida, or its odorous principle, becomes absorbed by the veins, though slowly. Flandrin⁴ gave half a pound of this gum-resin to a horse; the animal was fed as usual, and killed sixteen hours afterwards. The odour of assafoetida was distinguished in the veins of the stomach, of the small intestine, and the cæcum; it was not noticed in the arterial blood, nor in the lymph. Tiedemann and Gmelin⁵ were not successful in their search for it; they gave two drachms of assafoetida to a dog, and at the end of three hours were unable to recognize the odour of it, either in the chyle of the thoracic duct, or in the blood of the splenic and portal veins; but they detected it in the stomach and small intestines. In farther proof of the opinion that assafoetida becomes absorbed, may be mentioned the detection of the odour of this substance in the secretions. The experience of MM. Trousseau and Pidoux, already related, may be adduced as corroborative of this statement. We are told that the transpiration of Asiatics who use assafoetida daily, is extremely fetid; a circumstance to which Aristophanes⁶ alludes. Vogt⁷ says that the secretions from carious ulcers sometimes smell of assafoetida, when this substance has been taken for some time.

The stimulant influence of assafoetida over the organs of circulation and of secretion (as the bronchial membrane and skin) depends apparently on the topical action

¹ Wibmer, *Wirk d. Arzneim. u. Gifte*, Bd. ii. 366.

² *Lectures*, in the *Lancet*, April 14, 1838.

³ *Versuch*, S. 9.

⁴ *Pharmakodyn.* ii. 126, 2te Aufl.

⁵ *Traité de Thérap.* pp. 12, 13.

⁶ *Magendie, Physiol.* by M. Hagen, 2:5, 1823

⁷ *Equites*, Act. ii. Scen. 4.

of the oily and resinous particles on the vessels in their passage through the latter.

USES.—From the foregoing remarks, it will be readily gathered that assafoetida is contraindicated in febrile and inflammatory diseases, on account of its stimulant properties; as also in vascular irritation or inflammation of the stomach, on account of its topical influence on this viscus. On the other hand, it is found highly useful in spasmodic or convulsive diseases, not dependent on disease of the nervous centres, but of the kind called by Dr. Hall eccentric.

1. *In spasmodic and convulsive diseases.*—Few remedies have acquired such celebrity in *hysteria* as assafoetida. Dr. Cullen¹ speaks in the highest terms of it, and I believe the experience of most practitioners corroborates his opinion of its virtues. "I have found it," says he, "to be the most powerful in all hysteric cases; and when the presence of an hysteric paroxysm prevented medicines being taken by the mouth, I have found it given in clyster to be very effectual." When the circulation is very languid, ammonia may with advantage be conjoined. Schönheyder² recommends assafoetida with opium, in the form of clyster. In *infantile convulsions*, clysters of assafoetida are often used with good effect. Even in the *epilepsy* of adults they are not always without value. In purely *spasmodic asthma*, I have never seen relief from the use of assafoetida. This observation, which accords with Dr. Cullen's experience, does not agree with the statements of others. Trousseau and Pidoux³ declare they have seen it produce good and undoubted effects. But in old chronic catarrhs, with occasional spasmodic difficulty of breathing and spasmodic cough, I have procured the most marked relief by the combined use of assafoetida and ammonia. I have no experience of the use of this gum-resin in the disease called *laryngismus stridulus*, in which Millar⁴ and others have found it beneficial. In *hooping-cough*, both Millar and Kopp⁵ have found it beneficial. It promotes expectoration, and diminishes both the violence and frequency of the attacks. The repugnance which children manifest to its use is, however, a great drawback to its employment. In *flatulent colic* of hysterical and dyspeptic individuals, or of infants, few remedies are more efficacious, when the disease is unaccompanied by any marks of inflammatory action, and is attended with constipation. Of its efficacy in the flatulent colic of infants, I can speak from repeated observation; it is given with great benefit in the form of clyster. In most cases, its laxative operation is an advantage; but should this be an objection, it may be counteracted by the addition of laudanum.

2. *As a stimulating expectorant and antispasmodic in chronic catarrh*, it is often of considerable use. It is adapted for old persons, and where the disease is of long standing. I have found it most beneficial in those cases where the cough and difficulty of breathing assume at intervals a spasmodic form, and where the wheezing is considerable. In such, I have found full doses of assafoetida with ammonia give great relief. In delicate females, subject to repeated attacks of catarrh, attended with wasting, sweating, and other constitutional symptoms of phthisis, I have found assafoetida of frequent benefit. In these cases, it does not act merely by its expectorant effects, for oftentimes one good consequence of its use is diminution of excessive bronchial secretion.

3. *In affections of the alimentary canal.*—The use of assafoetida in *flatulent colic* has been above noticed. It is often of considerable value in relieving flatulence in old persons, especially in hypochondriacal and hysterical subjects, and when accompanied with constipation, as it has a laxative effect. It provokes the expulsion of the gaseous matter, and appears to aid in preventing its reproduction. It is beneficially used in the form of clyster, to relieve a tympanitic condition of the abdomen and flatulent distension of the bowels in low fevers. In *constipation with flatulence*, it is a useful addition to purgative mixtures or enemata. It has often been used as an *anthelmintic*; but is of less frequent efficacy.

¹ *Mat. Med.* ii. 367.

² *Op. cit.* p. 15.

³ *Lond. Med. Gaz.* i. 581.

⁴ *Acta. Reg. Soc. Hafn.* i. 168.

⁵ *Observations on the Asthma and Hooping-Cough*, 1769.

4. *As an emmenagogue in uterine obstructions* (amenorrhœa and chlorosis), assafoetida has been employed from a notion that it specifically affected the womb—an opinion which is supported by the reports of Jörg's female pupils, that it brought on the catamenial discharge earlier than usual. Experience, however, has not been much in favour of the emmenagogue operation of assafoetida when this remedy has been employed in uterine diseases. "Whether it be owing," says Dr. Cullen, "to the imperfect state in which we too frequently have this medicine, or to somewhat in the nature of the amenorrhœa, I would not positively determine; but this is certain, that I have very seldom succeeded in employing the assafoetida as an emmenagogue."

5. *As a condiment*.—I have already referred to the condimentary uses made of assafoetida, especially by oriental nations. At the Pass of "Dundan Shikun," says Lieutenant Burnes,¹ "we found the assafoetida plant in exuberance, and which our fellow-travellers ate with great relish." It is much used by the Brahmins against flatulence, and to correct their cold vegetable food.²

ADMINISTRATION.—The dose of assafoetida is from grs. v. to ℥j or ʒss. It may be given in substance, in the form of *pill*, or made into an *emulsion*. In hysteria and flatulent colic, where we want an immediate effect, it is best administered in a liquid form. Used as an *enema*, it may be administered to the extent of two drachms, rubbed up with warm water. The following are the officinal preparations of assafoetida:—

1. ENEMA ASSAFŒTIDÆ, L. [*Enema Fœtidum*, D. E.]; *Assafoetida* or *Fetid Clyster*.—(Assafoetida, prepared, ʒj; Decoction of Barley Oss. Beat up the assafoetida with the decoction gradually added until they are perfectly mixed. According to the Dublin Pharmacopœia, two drachms of the tincture are to be added to twelve ounces of water.)—The fetid clyster is a valuable stimulant, antispasmodic, and carminative purgative, which may be used with most beneficial results in hysteria, flatulent colic, infantile convulsions, and worms in the rectum.

2. TINCTURA ASSAFŒTIDÆ, L. E. D. [U. S.]; *Tincture of Assafoetida*.—(Assafoetida, in small fragments, ʒv (ʒiv, U. S.); Rectified Spirit Oij. Macerate for fourteen [seven, L. E.] days, and strain. "This tincture cannot be made by percolation, without much delay," E.)—Stimulant and antispasmodic. Used in hysteria and flatulent colic. Dose, ʒss to fʒij. Pennyroyal is a good vehicle for it. When mixed with aqueous liquids, it becomes milky, owing to the deposition of the hydrated resin.

3. PILULÆ ASSAFŒTIDÆ, D. E. [U. S.]; *Assafoetida Pills*.—(Assafoetida, Galbanum, and Myrrh, *three parts* of each; Conserve of Red Roses *four parts*, or a sufficiency; mix them, and beat them into a proper pill mass, E.—Galbanum ʒj; Myrrh and Treacle, of each ʒj; Assafoetida ʒij. Heat all the ingredients in a capsule, by means of a steam or water bath, and stir the mass until it assumes a uniform consistence, D.)—As the most powerful ingredient of this combination is assafoetida, the more appropriate name for the pills would be *pilulæ assafœtidæ compositæ*. This compound is stimulant and antispasmodic. It is used in hysteria, chlorosis, &c. Dose, grs. x to ℥j. The *Pilule Assafœtidæ* (U. S.) is composed of Soap and Assafoetida, 1 part of the former to 3 of the latter.

4. PILULÆ ALOES ET ASSAFŒTIDÆ, E.—(Socotrine Aloes, Confection of Roses, Assafoetida, Soap, of each equal parts. Mix.)—An antispasmodic and purgative, allied to the *Pilula Sagapeni Composita* of the former London Pharmacopœias.

This preparation of the *U. S. Pharm.* is composed of equal parts of Aloes, Assafoetida, and Soap.

5. SPIRITUS AMMONIÆ FŒTIDUS, L. E. D. (See vol. i. p. 437.)

6. EMPLASTRUM ASSAFŒTIDÆ, E. [U. S.]; *Plaster of Assafoetida*.—(Litharge Plaster, Assafoetida, of each ʒij; Galbanum, Beeswax, of each ʒj. Liquefy

¹ *Travels*, i. 143.

² Ainslie, *Materia Indica*, vol. i. 21.

the gum-resins together, and strain them; then add the plaster and wax, also in the fluid state, and mix them all thoroughly.)—It is applied as an antispasmodic, over the stomach or abdomen in hysteria with flatulence, to the chest or between the shoulders in whooping-cough.

[7. MISTURA ASSAFŒTIDÆ [U. S.]; *Assafœtida Mixture*.—Take of Assafœtida 3ij; Water Oss. Rub the assafœtida, with the water gradually added, until they are thoroughly mixed. Dose fʒss.]

246. FERULA? AN UNCERTAIN SPECIES YIELDING SAGAPENUM, L.

Sez. Syst. Pentandria, Digynia.

(Gummi-resina, L.)

HISTORY.—Sagapenum (σαγαπηνον) is mentioned both by Hippocrates¹ and Dioscorides.² Pliny³ calls it *Sacopenium*. Dioscorides says it is a liquor obtained from a ferulaceous plant growing in Media.

BOTANY.—Nothing is known with respect to the plant yielding sagapenum. Willdenow considered it to be *Ferula persica*, and he has been followed by Sprengel and Fée. But his opinion was not supported by any well-ascertained fact; on the contrary, several circumstances already mentioned seem to show that this plant produces a kind of assafœtida. There is, indeed, no evidence to prove that sagapenum is got from a *Ferula*, for the statement of Dioscorides cannot be admitted as having much weight.

DESCRIPTION.—Two kinds of sagapenum (*sagapenum*; *gummi sagapenum*) are occasionally met with. The finest (*sagapenum in the tear*) consists of masses made up of agglutinated, brownish-yellow, semitransparent tears, and resembling galbanum, but having a darker colour and a more alliaceous odour. A commoner kind (*soft sagapenum*) occurs in soft, tough masses, in which no distinct tears are distinguishable. When heated on the point of a knife in the candle, sagapenum gives out a much more aromatic and agreeable odour than galbanum. It has a hot and acrid taste. It is imported from the Levant.

COMPOSITION.—Sagapenum has been analyzed by Pelletier,⁴ and by Brandes.⁵

Pelletier's Analysis.

Resin	54.26
Gum	31.94
Volatile oil and loss	11.80
Bassorin	1.00
Malate of lime	0.40
Peculiar matter	0.60
Sagapenum	100.00

Brandes's Analysis.

Resin	50.29
Gum, with calcareous salts	32.72
Volatile oil	3.73
Bassorin	4.48
Malate and phosphate of lime	1.12
Impurities	4.30
Water	4.60
Sagapenum	101.24

1. **OIL OF SAGAPENUM.**—Pale yellow, lighter than water, soluble in alcohol and ether. Has a strong alliaceous odour, and a mild (afterwards hot) bitter, alliaceous taste. Sulphuric acid renders it dark red.

2. **RESIN OF SAGAPENUM.**—Obtained by evaporating an alcoholic solution, it is pale yellow, having a strong garlic odour, and becoming fluid at 212° F. Its composition, according to Johnston, is C⁴⁰H²⁰O⁹. By the action of ether it is resolved into two resins.

a. *Resin insoluble in ether.*—Brownish-yellow, tasteless, odourless, fusible, soluble in warm liquor potassæ and in spirit, but insoluble in the oils of turpentine and almonds.

β. *Resin soluble in ether.*—Reddish-yellow, with a feeble odour of sagapenum, and a mild (afterwards bitter) taste. It is soluble in spirit, and slightly so in the oils of turpentine and almonds. It dissolves in sulphuric acid, forming a blood-red solution, from which water separates a violet substance.

PHYSIOLOGICAL EFFECTS AND USES.—Its effects and uses are the same as those of assafœtida. It is usually considered to hold an intermediate rank between assafœtida and galbanum; but it is rarely employed.

¹ Page 626, ed. Fars.

² *Hist. Nat. lib. xx.* cap. 75, ed. Valp.

³ Gmelin, *Handb. d. Chem.* ii. 625.

⁴ Lib. iii. cap. 95.

⁵ *Bull. de Pharm.* iii. 481.

ADMINISTRATION.—It is given in substance, in the form of pill, in doses of from grs. v. to ℥j. or ℥ss.

1. SAGAPENUM PRÆPARATUM, L.—(Prepared in the same manner as directed for Ammoniacum; vide *Ammoniacum præparatum*.)—It enters into the composition of the *Pilula Galbani Composita* of the London Pharmacopœia (see *post*). Sagapenum is used as a warm stimulating purgative in dyspepsia, with flatulence and costiveness. Dose, grs. v. to ℥j.

247. DOREMA AMMONIACUM, Don.—THE AMMONIACUM DOREMA.

Sex. Syst. Pentandria, Digynia.

(Gummi resina, L.—Gummy-resinous exudation, E.)

[Ammoniacum, U. S.]

HISTORY.—The term *ammoniacum* has been applied to two different gum-resins; one, the produce of *Ferula tingitana*; the other, of *Dorema Ammoniacum*. The first is the ammoniacum of Hippocrates,¹ Dioscorides,² and Pliny;³ the latter is the commercial ammoniacum of the present day.

Dioscorides says ἀμμωνιακόν is obtained from a species of *Ferula*, which he calls ἀγασσολίς, growing near Cyrene, in Africa. Pliny terms the plant *Metopium*, and says it grows in that part of Africa which is subject to Æthiopia, near the temple of Jupiter Ammon, which, as well as the gum-resin, received its name from ἄμμος, sand, on account of the sandy soil of the country. Both Dioscorides and Pliny mention two kinds of ammoniacum: the best, called *Thrauston* (Θραῦστος), resembled olibanum, and had an odour like castoreum, and a bitter taste; and the commonest, termed *Phyrama* (φύραμα) had a resinous appearance, and was adulterated with earth and stones. *African ammoniacum* (in Arabic, *Fasogh* or *Feshook*) is, Dr. Lindley informs me, “certainly the product of *Ferula tingitana*.”

I have not been able to ascertain when *Persian ammoniacum* (the produce of *Dorema Ammoniacum*) first came into use. As the Greeks and Romans make no mention of it, they were, probably, unacquainted with it. Avicenna⁴ does not mention the origin of his ammoniacum (*assach*, Arab). The ammoniac (*eschak*, Arab.) of Abu Mansur Mowafk,⁵ an ancient Persian physician, who wrote about 1055 A. D., was doubtless of the Persian kind; as was also the ammoniac (*derukht ushak*) of Beva Ben Khuas Khan, A. D. 1512.⁶ The Arabic terms (*assach*, *ushak*, and *oshac*) by which the three last-named authors designate ammoniac, resemble the name (*oshac*) by which the ammoniacum plant is now known in Persia;⁷ hence we infer they all referred to the same object.

BOTANY. *Gen. Char.*—Epigynous disk cup-shaped. *Fruit* slightly compressed from the back, edged; with three distinct, filiform, primary ridges near the middle, and, alternating with them, four obtuse secondary ridges; the whole enveloped in wool. *Vitæ*, 1 to each secondary ridge, 1 to each primary marginal ridge, and 4 to the commissure, of which two are very small (Lindley).

Sp. Char.—The only species.

A glaucous green plant, about 7 feet high, looking like the *Opoponax*. *Root* perennial. *Stem* about 4 inches in circumference at the base. *Leaves* large, petiolate, somewhat bipinnate, 2 feet long; pinnæ in three pairs; petioles downy, sheathing at the base. *Umbels* proliferous, racemose; partial ones globose, on short stalks, often arranged in a spiked manner. *Involucre*, general or partial, none. *Petals* white. *Stamens* and *styles* white. *Ovaries* buried in wool. *Fruit* naked. (Condensed from Don.)

¹ Page 670, ed. Fœs.

² *Hist. Nat.* lib. xii. cap. 49, ed. Valp.

³ *Lib. Fund. Pharm.* i. 35, in ed. R. Seligmann, 1890.

⁴ *Linn. Trans.* xvi. 605.

² *Lib. iii.* cap. 98.

⁴ *Lib. ii.* cap. 8.

⁶ Ainslie, *Mat. Ind.* i. 160.

Hab.—Persia, in the province of Irak, near Jezud Khast, and on the plains between Yerdekaust and Kumisha.

EXTRACTION.—The whole plant is abundantly pervaded with a milky juice, which oozes forth upon the slightest puncture being made, even at the ends of the leaves. This juice, when hardened, constitutes ammoniacum. Through the kindness of my friend Dr. Lindley, there is in my museum the upper part of the (apparently flowering) stem, about ten inches long, with lumps of ammoniacum sticking to it at the origin of every branch. It was gathered by Sir J. M'Niell, in Persia (I believe between Ghorian and Khaff). It does not appear that artificial incisions are ever made in the stem. Lieut. Col. Kennet¹ says: "When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions; it [ammoniacum] soon becomes dry, and is then picked off, and sent *via* Bushire to India, and various parts of the world."

COMMERCE.—Ammoniac is usually imported from Bombay, but occasionally it comes from the Levant. It is brought over in chests, cases, and boxes. The quantity imported is but small.

DESCRIPTION.—Common or Persian ammoniacum, usually termed *gum ammoniacum* or *ammoniac* (*gummi ammoniacum*), occurs in two forms; *in the tear* and *in the lump*.

α. Ammoniacum in the Tear (*Ammoniacum in lachrymis seu granis*) occurs in distinct dry tears, usually more or less spheroidal, though frequently of irregular forms, varying in size from that of the fruit of coriander (or even smaller) to that of a walnut. Externally, they are of a yellow (pale reddish or brownish) colour, with a waxy lustre; internally, they are white or opalescent, opaque, or only feebly translucent at the edge of thin films. At ordinary temperatures it is moderately hard and brittle, but softens like wax in the hand.

β. Lump Ammoniacum (*Ammoniacum in placentis seu massis*).—This occurs in masses usually composed of agglutinated tears, whose properties it possesses. It is sometimes met with in soft plastic masses of a darker colour, and mixed with various impurities. To separate these, it is melted and strained (*Strained ammoniacum*; *Ammoniacum colatum*).

Both kinds have a faint, unpleasant, peculiar odour, by which this gum-resin may be readily distinguished from all others. This odour is best detected by heating the ammoniacum on the point of a penknife. The taste is bitter, nauseous, and acrid. Umbelliferous fruits are not unfrequently found intermixed with both sorts. In most of its other properties ammoniacum agrees with other gum-resins.

I am indebted to Dr. Lindley for a fine sample of *African Ammoniacum* (ἀφρικανικόν, Diosc.). It was sent by W. D. Hays, Esq., the British Consul at Tangier, to the Hon W. T. Fox Strangways, and is marked, "*Gum Ammoniac* or *Fusògh*, Tangier, 17 June, 1839, J. W. D. H." It is an oblong piece, about three inches long, and one and a half inch thick, and broad. Its weight is about 830 grains. Externally, it is irregular and uneven, and has a dirty appearance, similar to what ammoniacum would acquire from repeated handling and long exposure to the air in a dusty situation. It is partially covered with paper. A few pieces of reddish chalky earth (which effervesces with acids) are found sticking to it, thus confirming the account given of it by Jackson,² though the quantity of this on my specimen is not sufficient to affect in any way the solubility of it. It appears to be made up of agglutinated tears, like the lump Persian ammoniacum. Internally, it has very much the appearance of lump ammoniacum, but is not so white, but has a brownish, reddish, and in some places a faint bluish tint. Its odour is very faint, and not at all like Persian ammoniacum. Heated on the point of a knife, its distinction from Persian ammoniacum is very obvious. Its taste is also much slighter than that of the commercial ammoniacum. Rubbed with water, it forms an emulsion like the latter. It is the produce of *Ferula tingitana* (Lindley).

COMPOSITION.—Ammoniacum has been analyzed by Calmeyer, Bucholz,³ Bracconot,⁴ and by Hagen.⁵

¹ Linn. Trans. xvi. 605.

² Gmelin, Handb. d. Chem. ii. 624.

³ Schwartz, Pharm. Tabel. 280, 2te Ausg.

⁴ Account of the Empire of Morocco, 3d edit. p. 156.

⁵ Ann. de Chem. lxxviii. 69.

Braconnot's Analysis.

Resin	70.0
Gum	18.4
Gluteniform matter, insoluble in water and alcohol	4.4
Water	6.0
Loss	1.2
Ammoniacum	100.0

Hagen's Analysis.

Resin	68.6
Gum	19.3
Gluten (colla)	5.1
Extractive	1.6
Sand	2.3
[Volatile oil and water]	2.8
Ammoniacum	100.0

1. VOLATILE OIL OF AMMONIACUM.—Transparent, lighter than water.

2. RESIN OF AMMONIACUM.—Reddish-yellow, tasteless, has the odour of the gum-resin. Soluble in alkalies and alcohol; partially soluble in ether and the oils (fixed and volatile). Its constitution, according to Johnston, is $C^{40}H^{25}O^9$.

PHYSIOLOGICAL EFFECTS.—The effects of ammoniacum are similar to, though less powerful than, those of assafoetida and of the other fetid gum-resins already mentioned. MM. Trousseau and Pidoux¹ assert that, in all the cases in which they have employed it, it had no stimulant effect either local or general. "We have taken," say these authors, "two drachms of this substance at once, without experiencing any of those accidents complaisantly indicated by authors." I would remark, however, that the local irritation produced by the plaster of ammoniacum is known to most practitioners, a papular eruption being a frequent result of the application of this agent. Ammoniacum contains much less volatile oil than either assafoetida or galbanum; its stimulant influence is less than either of these. Full doses of it readily disturb the stomach.

USES.—Though applicable to all the same cases as assafoetida and the other fetid gum-resins, its internal use is principally or almost solely confined to chronic pulmonary affections. It is not fitted for irritation or inflammation of the bronchial membrane. But in chronic coughs, with deficient expectoration, or in chronic catarrhs and asthmatic cases of old persons with profuse secretion, it sometimes gives slight relief. Though I have seen it extensively employed, in a few cases only have I observed it beneficial. As a topical, discutient, or resolvent application, in the form of plaster, to glandular enlargements and indolent affections of the joints, it occasionally proves useful.

ADMINISTRATION.—The dose of ammoniacum is from grs. x to ʒss. It may be given in the form of pill or emulsion. It is a constituent of the *Compound pills of squills*, a very useful expectorant in old catarrhs.

1. MISTURA AMMONIACI, L. D. [U. S.]; *Lac Ammoniaci*; *Ammoniacum Mixture*.—(Ammoniacum ʒv [ʒij, U. S.], [ʒij, D.]; Water Oj [Oss, U. S.]; [Water fʒviij, D.] Rub the ammoniacum with the water gradually poured on, until they are perfectly mixed. [It should be strained through muslin, D.].—The resinous constituent of ammoniacum is more effectually suspended in water by the aid of the yolk of an egg. This mixture operates as a stimulant to the bronchial membrane, and is used as an expectorant in chronic coughs, humoral asthma, &c. It is a convenient and useful vehicle for squills or ipecacuanha. Dose, fʒss to fʒj.

2. EMPLASTRUM AMMONIACI, L. E. D. [U. S.]; *Plaster of Ammoniacum*.—(Ammoniacum ʒv; Diluted Acetic Acid fʒviij; [Distilled Vinegar fʒix, E.; Gum Ammoniac, in coarse powder, ʒiv; Proof Spirit fʒiv, D.] Dissolve the ammoniacum in the acid, vinegar, or spirit, then evaporate the liquor with a slow fire, L. [over the vapour-bath, E.; or water-bath, D.], constantly stirring, to a proper consistence. The best solvent is undoubtedly proof spirit, as recommended in the Dublin Pharmacopœia.)—A very adhesive, stimulant, and discutient or resolvent plaster. It sometimes causes an eruption. It is applied to indolent swellings, as of the glands and joints. A very useful application to the housemaid's swollen knee.

3. EMPLASTRUM AMMONIACI CUM HYDRARGYRO, L. E. D. [U. S.] (See vol. i. 786.) [The appearance of a new edition of the Dublin Pharmacopœia, since the first vo-

lume of this work was printed, renders it necessary to state here that the Emplastrum Ammoniaci cum Hydrargyro is no longer made as there directed. The present formula is Ammoniac Plaster ℥iv, and Mercurial Plaster ℥viij. These plasters are melted together by means of a steam- or water-bath, and constantly stirred until the mixture stiffens on cooling.—Ed.]

4. AMMONIACUM PRÆPARATUM, L. ; *Prepared Ammoniacum*.—(Ammoniacum, in the mass, 1b j ; Water, as much as may be necessary to cover the ammoniacum. Boil until mixed ; strain the mixture through a hair sieve, and evaporate by water-bath, carefully stirring, so that it hardens on cooling.)—This cleansing is only necessary for the ammoniacum as obtained in the mass (*lump ammoniacum*), but is not required for the *tear ammoniacum*.

248. GALBANUM OFFICINALE, Don.—OFFICINAL GALBANUM.

Sex. Syst. Pentandria Digynia.

(Gummi-resina, L. D.—Concrete gummy-resinous exudation of an imperfectly ascertained umbelliferous plant, probably a species of Opoidia, E.)

HISTORY.—Galbanum is mentioned by Moses,¹ who ranks it among the sweet spices. It was used in medicine by Hippocrates.² Dioscorides³ says it (χαλβανή) is the μετώπιον, growing in Syria.

BOTANY.—Much uncertainty still exists respecting the plant which yields galbanum. "The *Bubon Galbanum* of Linnæus possesses neither the smell nor the taste of Galbanum, but in these particulars agrees better with Fennel, and the fruit has no resemblance whatever to that found in the gum."⁴ The *Dublin College*, in its new Pharmacopœia, describes galbanum as the gum-resinous exudation of the *Opöidia galbanifera*. This is assigned on the authority of Lindley. Mr. Don found an umbelliferous fruit in the galbanum of commerce, which he believes to be that of the plant yielding this gum-resin ; and, as it constitutes a new genus, he has called it *Galbanum officinale*. The following are the characters of the fruit :—

Fruit compressed at the back, elliptical ; ridges, seven, elevated, compressed, bluntly keeled, not winged ; the lateral distinct, marginal. Channels broadish, concave, without vittæ. *Commissure* flat, dilated, bivittate ; *vittæ* broad, somewhat curved. (Don.)

But though it is not at all improbable that these fruits are the produce of the galbanum plant, yet no proof of this has been hitherto adduced, and Dr. Lindley, therefore, very properly asks : "Did the fruit found by Mr. Don upon the gum really belong to it?"⁵

More recently, Sir John M'Niell sent home specimens of a plant called a *second sort of ammoniacum*, gathered near Durrood, July 27, 1838, to the branches of which are sticking lumps of a pale yellow waxy gum-resin, which Dr. Lindley took for galbanum ; and the plant which yields it being essentially different from all others, has been named by him *Opöidia galbanifera*,⁶ the name now selected by the *Dublin College*. Dr. Lindley was kind enough to send me a small fragment of this gum-resin for examination, but I was unable to identify it with any other known product of the order Umbelliferae. It certainly was neither assafœtida nor ammoniacum ; nor did it appear to me to be either sagapenum or galbanum. The precise country where galbanum is produced has not been hitherto ascertained. Dioscorides says it is obtained in Syria ; a statement which is perhaps correct, though hitherto no evidence of this has been obtained. It is not improbable that it is also procured in Persia, or even in Arabia, as suggested by Dr. Royle. *Opöidia galbanifera* grows in the province of Khorasan, near Durrood. The German pharmacologists

¹ Exodus xxx. 34.

² Ibid. iii. 97.

³ Ft. Med. 51.

⁴ Page 401, &c. ed. Fœs.

⁵ Don, Linn. Trans. xvi. 603.

⁶ Botanical Register for August 1, 1839, pp. 65-6.

distinguish two varieties—*Galbanum Levanticum* and *Galbanum Persicum*. The names indicate the localities whence they are supposed to be derived.

EXTRACTION.—Geoffroy¹ says, though I know not on whose authority, that galbanum is generally obtained by making an incision into the stalks about three fingers' breadth above the root, from which it issues in drops, and in a few hours becomes dry and hard enough to gather.

DESCRIPTION.—The gum-resin galbanum (*galbanum seu gummi-resina galbanum*) occurs in the two forms of tears and lumps.

a. Galbanum in the Tear (*galbanum in lachrymis seu granis*) is rare; it occurs in distinct, round, yellow, or brownish-yellow, translucent tears; none of which, in my collection, exceed the size of a pea. Their fracture is feebly resinous and yellow.

β. Lump Galbanum (*galbanum in massis*) is the ordinary galbanum of commerce. It consists of large irregular masses of a brownish or dark brownish-yellow colour, and composed of agglutinated tears; some few of which, when broken, are observed to be translucent and bluish, or pearl-white. The mericarp, pieces of the stem, &c. are found intermixed with the tears. To separate these, galbanum is melted and strained (*strained galbanum*; *galbanum colatum*). The odour of both kinds is the same, viz. balsamic and peculiar. The taste is hot, acrid, and bitter. When exposed to cold, galbanum becomes brittle, and may be reduced to powder. In many of its other properties, it agrees with the other gum-resins. It is imported from the Levant and from India in cases and chests.

Recently, another gum-resin from India has been introduced as galbanum; but it is said to resemble the latter in colour only, and to be unsalable.²

COMPOSITION.—Galbanum has been analyzed by Neumann,³ Pelletier,⁴ Fiedelchow, and Meissner.⁵

<i>Pelletier's Analysis.</i>		<i>Meissner's Analysis.</i>	
Resin	66.86	Resin	65.8
Gum	19.28	Gum	22.6
Volatile oil and loss	6.34	Bassorin	1.8
Wood and impurities	7.52	Volatile oil	3.4
Supermalate of lime	traces	Bitter matter with malic acid	0.2
Galbanum	100.00	Vegetable remains	2.4
		Water	2.0
		Loss	1.4
		Galbanum	100.0

1. VOLATILE OIL OF GALBANUM.—Obtained by submitting the gum-resin, with water, to distillation. It is colourless and limpid. Its sp. gr. is 0.912; its odour is like that of galbanum and camphor; its taste is hot, afterwards cooling and bitterish. It is soluble in spirit, ether, and the fixed oils.

2. RESIN.—Is the residue obtained by boiling the alcoholic extract of galbanum in water. It is dark yellowish-brown, transparent, brittle, and tasteless; soluble in ether and alcohol, scarcely so in spirit containing 50 per cent. of water, or in almond oil. Very slightly soluble in oil of turpentine, even when aided by heat. It dissolves in oil of vitriol, forming a dark yellowish-brown liquid. According to Pelletier, galbanum-resin has the remarkable property of yielding an indigo blue oil when heated to 248° F. or 266° F. The composition of galbanum-resin is, according to Johnston, $C^{40}H^{27}O^7$.

PHYSIOLOGICAL EFFECTS.—The general effects of galbanum are those of the fetid antispasmodic gum-resins already described. It is usually ranked between assafoetida and ammoniacum, being weaker than the former but stronger than the latter. As it yields, by distillation, more volatile oil than assafoetida does, it has been supposed that it must exceed the latter in its stimulant influence over the vascular system; but as an antispasmodic, it is decidedly inferior to assafoetida. A specific stimulant influence over the uterus has been ascribed to it; hence the Germans call it *Mutterharz* (i. e. *uterine resin*).

¹ *Trait. de Mat. Méd.* ii. 623.

² Mr. E. Solly, *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 144, Lond. 1841.

³ *Pfaff. Syst. de Mat. Méd.* iii. 294.

⁴ *Bull. de Pharm.* iv. 97.

⁵ Schwartz, *Pharm. Tabel.* 284, 2te Aug.

USES.—Galbanum is principally adapted for relaxed and torpid habits, and is objectionable in inflammatory or febrile disorders. It is employed in the same cases as assafoetida, with which it is generally given in combination. It is principally used in chronic mucous or pituitous catarrh, in which it oftentimes proves serviceable. It has also been employed in amenorrhœa and chronic rheumatism. Externally, it is applied as a mild stimulant, resolvent, or suppurant, in indolent swellings.

ADMINISTRATION.—It may be given in *substance*, in the form of pill, in doses of from grs. x to ʒss, or in the form of *emulsion*.

1. PILULÆ GALBANI COMPOSITÆ, L.—(Prepared Galbanum ʒij; Myrrh, Prepared Sagapenum, each ʒiij; Prepared Assafoetida ʒj; Soft Soap ʒij; Treacle, as much as may be necessary. Beat all together that a mass may be formed.)—Dose, gr. x to gr. xx.

2. EMPLASTRUM GALBANI, L.; *Emplastrum gummosum*, E.; *Plaster of Galbanum*.—(Galbanum ʒviiij; Plaster of Lead lbiiij; American Turpentine ʒj; Prepared Frankincense, powdered, ʒiij. Add first the Frankincense, then the Plaster of Lead melted over a slow fire, to the Galbanum and Turpentine melted together, and mix them all, L.—“Litharge Plaster ʒiv; Ammoniac, Galbanum, and Beeswax, of each ʒss. Melt the gum-resins together, and strain them: melt also together the plaster and wax; add the former to the latter mixture, and mix the whole thoroughly,” E.)—This plaster, spread upon leather, is applied to indolent tumours, to promote their suppuration, and to disperse them. Its operation appears to be that of a mild stimulant. It is also applied to the chest in chronic pulmonary complaints. In weakly, rickety children, with weakness of the lower extremities, it is applied to the lumbar region.

[*Emplastrum Galbani Compositum*, U. S., Compound Galbanum Plaster, is made as follows: Take of Galbanum ʒviiij; Turpentine ʒx; Burgundy Pitch ʒiij; Lead Plaster lbiiij. To the galbanum and turpentine, previously melted together and strained, add first the Burgundy pitch and afterwards the lead plaster melted over a gentle fire, and mix the whole together.]

3. GALBANUM PRÆPARATUM, L.—This is directed to be prepared in the same manner as is ordered for the *prepared ammoniacum*.

249. OPOPONAX CHIRONIUM, Koch.—THE OPOPONAX.

Pastinaca, Opoponax, Linn.

Sex. Syst. Pentandria, Monogynia.

(Gummi-resina.)

HISTORY.—Hippocrates,¹ employed opoponax (παπάξ). Theophrastus² mentions four, and Dioscorides³ three kinds of παπάξ. The latter of these writers has given a good account of opoponax (ὀποπάναξ), which he says is procured from παπάξ ἡράκλειον.

BOTANY. Gen. Char.—Margin of the *calyx* obsolete. *Petals* roundish, entire, rolled inward, with a rather acute lobe. *Stylopodium* broad, thick. *Styles* very short. *Fruit* flattened at the back, with a dilated convex margin. *Mericarps* [half-fruits] with three dorsal, filiform, very thin ridges, and no distinct lateral ones. *Vittæ* 3 to each channel, 6 to 10 to each commissure. *Seed* smooth.—Perennial herb. *Root* thick. *Stem* rough. *Leaves* bipinnatisect; segments unequally cordate, crenate, obtuse. *Umbels* compounded of many rays. General and partial *involucre* few-leaved. *Flowers* yellow. (De Cand.)

Sp. Char.—The only species.—A plant six or seven feet high, resembling the parsnip.

Hab.—Sunny parts of the south of France, Italy, Sicily, Croatia, and Greece.

¹ *Opera*, p. 402, ed. Fœss.

² *Lib. ii. cap. 55-7.*

² *Hist. Plant. lib. ix. c. 12.*

EXTRACTION.—According to Dioscorides, whose account is probably correct, this gum-resin is obtained by incisions into the root; a milky juice exudes, which, by drying, becomes yellow, and forms opoponax.

DESCRIPTION.—Opoponax (*gummi opoponax*) occurs in irregular yellowish-red lumps (*opoponax in massis*), or in reddish tears (*opoponax in lachrymis*). It has an acrid bitter taste, and an unpleasant odour. Rubbed with water it forms an emulsion. Its general properties as a gum-resin have been already noticed.

COMPOSITION.—Opoponax has been analyzed by Pelletier.¹ He found the constituents to be:—

Resin	42.0
Gum	33.4
Starch	4.2
Extractive	1.6
Wax	0.3
Malic acid	2.8
Lignin	9.8
Volatile oil, traces of caoutchouc, and loss	5.9
Opoponax	100.0

RESIN.—Reddish-yellow; fusible at 122°F. Soluble in alkalies, alcohol, and ether. The alkaline solution is reddish; the resin is precipitated from it by hydrochloric acid, in the form of yellow flocks. Nitric acid acts freely on the resin. Its composition, according to Johnston, is $C^{40}H^{25}O^{14}$.

PHYSIOLOGICAL EFFECTS.—Similar to the other fetid, antispasmodic gum-resins. It is, perhaps, more allied to ammoniacum than to any other of these substances.

USES.—Opoponax is rarely employed. It is adapted to the same cases as the other gum-resins of this class.

[Although opoponax no longer finds a place in any British Pharmacopœia, we have thought it desirable to retain the description given by the author; as, judging of the future by the past, it will probably be restored to the *Materia Medica* in a future edition of the *Pharmacopœia*.—ED.]

250. CONIUM² MACULATUM, Linn.—THE COMMON OR SPOTTED HEMLOCK.

Sez. Syst. Pentandria, Digynia.

Folia, L. E. D.

HISTORY.—This plant is usually supposed to be the *κώνειον* of the Greek writers—the celebrated *Athenian state poison*, by which Socrates³ and Phocion⁴ died—and the *cicuta* of the Roman authors. Various reasons contribute to give the common opinion on this point a high degree of probability. Dioscorides⁵ described the plant sufficiently well to prove it must have been one of the Umbelliferæ; and he tells us that it had a heavy odour, and a fruit like that of anise. The latter simile applies to our Conium, for a very intelligent druggist mistook, in my presence, the fruit of the hemlock for that of anise; and at the examination for M. B. at the University of London, in 1839, a considerable number of the candidates, to whom the hemlock fruit was shown, made the same mistake. Dioscorides also tells us that the *κώνειον* of Crete and Megara was the most powerful, and next to this came that of Attica, Chio, and Cilicia. Now, Dr. Sibthorp⁶ found *Conium maculatum* growing near Constantinople, not unfrequently in the Peloponnesus, and most abundantly between Athens and Megara. So that the locality of our Conium agrees, as far as has been ascertained, with that of the ancient plant. Moreover, *Conium maculatum*

¹ *Bull. de Pharm.* iv. 49.

² This word is sometimes incorrectly accented *co'nium*. But "those words which, in Greek, are written with *ei* before a vowel, and in Latin with *e* or *i*, have the *e* or *i* long; as *Enëas*, *Cassiopea*, *Cythæra*, *Centaurea*," &c. (Grant's *Institutes of Latin Grammar*, 2d edit. p. 343, 1823.)

³ *Works of Plato*, by T. Taylor, vol. iv.; *The Phædo*, p. 340.

⁴ *Lib. iv. cap. 79.*

⁵ *Pintarch's Lives.*

⁶ *Prodr. Fl. Græcæ*, i. 167.

is at this present time called by the Greeks *κάνελον*.¹ We may gather from the poetical account of the effects of *κάνελον* given by Nicander,² that this plant "brings on obliteration of the mental faculties, dimness of sight, giddiness, staggering, stifling, coldness of the limbs, and death by asphyxia; a view of its effects," says Dr. Christison,³ "which differs little from the modern notions of the poisonous action of the spotted hemlock." It is also remarkable that the ancients regarded *κάνελον* as having the power of discussing tumours—a virtue which has been assigned to hemlock by writers of the present day.

I am fully aware that the characters of the ancient plant, as given us by Dioscorides and Pliny,⁴ are insufficient to distinguish it from some other Umbelliferae; yet I think the evidence of its being our *Conium maculatum* is deserving of much greater confidence than Dr. Christison is disposed to give it. The absence of all notice, in the writings of the ancients, of the purple spots on the stem, has been urged against the probability of this opinion. "Pliny's term *nigricans*, applied to the stem, is but a feeble approach," says Dr. Christison, "to the very remarkable character of the modern plant, the purple-spotted stem." But in 1839, I showed to the pupils attending my lectures a stem of hemlock, to which the term *blackish* might be applied without greater impropriety of language than is daily made use of when a man is said to have a black eye; for the dark purple spots had coalesced so as to cover most completely the lower part of the stem. Admitting, however, that the term is not strictly correct, I would observe, first, that there is no poisonous umbelliferous plant to which it applies so well as to hemlock; and, secondly, Dioscorides and Pliny may be well excused for using it, seeing that a distinguished toxicologist described the spots on the stem as *blackish*.⁵

It is evident that our generic term *Conium* is derived from the Greek word *κάνελον*. Linnæus has been censured by Lamarek for using this name, since the Latin authors call our hemlock *Cicuta*, which he, therefore, contends ought to be its designation now. But it should be remembered that Linnæus has only restored its ancient name, for the word *Cicuta* is unknown to the Greek language. By modern botanists the latter term is applied to a distinct genus of plants; and when, therefore, we meet with it in botanical works, we must not confound it with the *cicuta* of the Romans. Especially careful should the student be not to confound *Conium maculatum* with *Cicuta maculata*. It is certainly much to be regretted that such a ground of confusion should exist, but I am afraid it is now too late to obviate it.

BOTANY. Gen. Char.—Margin of the *calyx* obsolete. *Petals* obcordate, somewhat emarginate, with a very short inflexed lobe. *Fruit* compressed at the side, ovate. *Mericarps* [half-fruits] with 5 prominent, undulated, crenulated, equal ridges, the lateral ones marginal. *Channels* with many striæ, but no vittæ. *Carphorus* bifid at the apex. *Seed* incised with a deep narrow groove, and confounded with it.—European, biennial, poisonous *herbs*. *Root* fusiform. *Stem* round, branched. *Leaves* decom-pound. Both partial and general *involucres*, 3- to 5-leaved; partial one, halved. *Flowers* white, all fertile. (De Cand.)

Sp. Char.—Leaflet of the partial *involucre* lanceolate. Partial *umbel* short. (De Cand.)

Root biennial, tap-shaped, fusiform, whitish, from 6 to 12 inches long, somewhat resembling a young parsnip. *Stem* from 2 to 6 feet high, round, smooth, glaucous, shining, hollow, spotted with dark purple. *Leaves* tripinnate, with lanceolate, pin-natifid leaflets, of a dark and shining green colour, smooth, very fetid when bruised, with long, furrowed foot-stalks, sheathing at their base. *Umbels* of many general as well as partial rays. *General involucre* of several (usually 3 to 7) leaflets; *partial in-*

¹ *Ελληνικὴ φαρμακοποιία*, 1837.

² *Transactions of the Royal Society of Edinburgh*, vol. xiii.

³ See Orfila, *Toxicol. Gén.* ii. 299, 1818.

[In a later edition of his *Toxicology* (1843), Orfila describes the stem of the plant as "offrant des taches d'une couleur pourpre foncée."] ⁴ *Alexipharmaca*, f. 34-5, Paris, 1549.

⁵ *Hist. Nat. lib.* xxv. cap. 95, ed. Valp.

⁶ *Toxicologie*, ii. 422, 1843.—

volucre of 3 leaflets on one side. Margin of *calyx* obsolete. *Petals* 5, obovate, white, with inflexed points. *Stamina* 5, epigynous, as long as the petals. *Ovarium* ovate, 2-celled, striated; *styles* 2, filiform, spreading; *stigma* round. *Fruit* ovate, compressed laterally; *mericarps* [half-fruits] with 5 primary, but no secondary, ridges, which are undulato-crenated; the channels have many striae, but no vittae. *Seed* with a deep, hollow groove in front.

Hab.—Indigenous; hedges and waste ground, especially near towns and villages. In other parts of Europe, the East of Asia, and in the cultivated parts of North America and Chili, into which it has been introduced.

In distinguishing *Conium maculatum* from other Umbelliferae, the following characters should be attended to: The large, round, smooth, spotted *stem*; the smooth, dark, and shining green colour of the lower *leaves*; the general *involute* of from 3 to 7 leaflets; the *partial involute* of 3 leaflets; the *fruit* with undulated, crenated, primary ridges. To these must be added, that the whole *herb*, when bruised, has a disagreeable smell (compared by some to that of mice, by others to that of fresh *cantharides*, or of cats' urine).

The indigenous Umbelliferae most likely to be confounded with *Conium maculatum* are, *Æthusa Cynapium* and *Anthriscus vulgaris*. *ÆTHUSA CYNAPIUM*, or *Fool's Parsley*, is distinguished from hemlock by its smaller size, by the absence of the strong disagreeable smell which distinguishes the *leaves* of hemlock, by the want of a general *involute*, by the 3 long, narrow, unilateral, pendulous leaflets composing the *partial involute*, by the *ridges* of the fruit being entire (i. e. not undulate or crenate), and by the presence of *vittæ*. *ANTHRISCUS VULGARIS*, or *Common Leaked Parsley*, is known from hemlock by the paler colour and slight hairiness of the *leaves*, by the absence of spots on the *stem*, by the swelling under each joint, by the absence of a general *involute*, by the roughness of the *fruit*, and by the absence of a strong unpleasant odour when the *leaves* are bruised. *ANTHRISCUS SYLVESTRIS* (*Charophyllum sylvestre*), or *Common Cone-Parsley*, is scarcely likely to be confounded with hemlock. The *stem*, though purplish, is striated, downy at the lower part, and slightly swollen below the joint; the *leaves* are rough-edged; there is no general *involute*; and the *partial* one usually consists of 5 or more leaflets.

DESCRIPTION.—The leaves (*folia conii*) only are officinal. They should be gathered from wild plants, just before the time or at the commencement of flowering. If intended for drying, the larger stalks should be removed, and the foliaceous parts quickly dried in baskets by the gentle heat (not exceeding 120° F.) of a proper stove. Exclusion from solar light contributes greatly to the preservation of the colour. If properly dried, the leaves should have a fine green colour, and their characteristic odour; and when rubbed with caustic potash they should evolve the odour of conia. They should be preserved in cool, closed, perfectly opaque, and dry vessels. Tin canisters possess these properties. However, no reliance can be placed on the dried leaves, however carefully prepared, for they sometimes yield no conia, though they possess the proper hemlock odour and a fine green colour. If the fresh leaves be subjected to pressure, they yield a greenish juice (*succus conii*), from which, on standing, a green *fecula* subsides. The fruit, commonly termed *hemlock seeds* (*fructus seu semina conii*), has very little odour, and a slight, somewhat bitterish taste. It retains for a much longer time than the leaves its active principle unchanged (see *Conia*).¹

COMPOSITION.—Schrader² made a comparative analysis of wild and cultivated hemlock, but with no important result. He also made a comparative examination of hemlock and cabbage (*Brassica oleracea*), the only curious part of which was, that he found a striking resemblance between them.³ Peschier⁴ found in hemlock a salt which he called *coniatic of conia*, being composed of a peculiar crystallizable acid (*coniic acid*, or coneic acid), and a peculiar base. Hemlock juice was analyzed by Bertrand;⁵ the leaves by Dr. Golding Bird;⁶ the ashes by Brandes.⁷ An ana-

¹ [Conia, like hydrocyanic acid, undergoes spontaneous changes, whereby it is resolved into ammonia and a bitter extractive matter, which is possessed of no poisonous properties. The salts of conia dissolved in water are thus rapidly converted into harmless substances. This tendency to spontaneous change, which is materially increased by a high temperature, may account for the variable proportion of the active principle in some of the preparations of Hemlock, as also for the conflicting accounts of authors regarding their medicinal action.—Ed.]

² Berlin. Jahrbuch, 1805. S. 152.

³ Pflaß, Syst. d. Mat. Med. Bd. vii. S. 300; Berzelius, Traité de Chim. vi. 254.

⁴ Recueil de Mém. de Méd. de Chir. et de Pharm. Mil. t. ix. p. 300.

⁵ Lond. Med. Gaz. xi. 248.

⁶ Schweigger's Journ. für Chem. Bd. v. S. 19, 1512.

⁷ Berlin. Jahrbuch, 1819, S. 116.

lysis of hemlock (leaves?) by the last-mentioned chemist is quoted by Mérat and De Lens.¹ Peschier and Brandes first announced the existence, in this plant, of a peculiar basic principle, which Giseke,² in 1827, obtained in combination with sulphuric acid. But Geiger,³ in 1831, procured it, for the first time, in an isolated form, and described some of its properties and effects on animals. It was afterwards examined by Dr. Christison,⁴ and by MM. Boutrou-Charlard and O. Henry.⁵

*Schrader's Analyses.**Brandes's Analysis.*

	Hemlock.	Cabbage.	
Extractive	2.73	2.34	Peculiar basic principle (<i>conicine</i>).
Gummy extractive	3.52	2.89	Very odorous oil.
Resin	0.15	0.05	Vegetable albumen.
Vegetable albumen	0.31	0.29	Resins.
Green fecula	0.80	0.63	Colouring matter.
Water, with acetic acid and various salts . . .	92.49	93.80	Salts
			[Lignin and water.]
Total	100.00	100.00	Hemlock.

1. **VOLATILE OIL OF HEMLOCK** (*Odorous principle*).—The distilled water of hemlock possesses, in a high degree, the characteristic odour of hemlock, but is scarcely, if at all, poisonous. Hence it is obvious that the odorous matter is not the active principle. Furthermore, it shows that the characteristic odour of hemlock, in the different preparations of this plant, is not to be taken as a necessary indication of their activity. Bertraud isolated the odorous matter, and found it to be a volatile oil of an acrid taste and peculiar odour.

2. **CONIA** Co (*Conicine*; *Concin*; *Ciculine*).—Exists in hemlock in combination with an acid (*conic acid*, Peschier); so that it cannot be recognized by its odour, nor obtained by distillation, without the assistance of an alkali. It exists, probably, in all parts of the plant, but is more copious in the fruit than in the leaves; and, most remarkably, it may be preserved for a much longer time in the former than in the latter. Geiger procured from 6 lbs. of fresh, and 9 lbs. of dried fruits, about one ounce of conia; whereas from 100 lbs. of the fresh herb he obtained only a drachm of this alkaloid. He could get traces only of it in fresh dried leaves, while he extracted a drachm of it from nine ounces of the fruit which had been preserved (not very carefully) for sixteen years. This by no means agrees with my own observations and experiments; for I have found that fruit which had been kept for three years yielded only a very minute portion of conia; though, from the same sample, when fresh gathered, I had obtained a considerable quantity. From 40 lbs. of the ripe, but green, seeds (mericarps), Dr. Christison obtained two ounces and a half of hydrated conia. Conia, free from all impurity but water, may be obtained by distilling the alcoholic soft or syrupy extract of the seeds (mericarps) with its own weight of water and a little caustic potash. The conia passes over readily, and floats on the surface of the water (which contains conia in solution). When pure, conia is an oily-looking, transparent liquid, lighter than water; sp. gr. 0.89. Its odour is strong, penetrating, and stupefying, somewhat like that of hemlock, or more analogous to a combination of the odours of tobacco and mice. Its vapour excites a flow of tears. Its taste is acrid; it is sparingly soluble in water, but is entirely soluble in alcohol and ether. It reddens turmeric, and neutralizes the dilute acids, forming salts. While saturating, the liquors have a bluish-green tint, which subsequently passes to a reddish-brown. It combines with about a fourth of its weight of water to form a *hydrate of conia*, in which state it has a strong alkaline reaction. When placed in a vacuum, in the presence of bodies very attractive of water, it in part volatilizes, and leaves a reddish, very acrid, pitchy residue, which appears to be anhydrous [partially decomposed?] conia. The vapour of conia is inflammable. By exposure to the air, liquid conia acquires a dark colour, and is resolved into a brown resin and ammonia. Its boiling point is 370° F. (335°?), but it readily distils with water at 212° F. [It is partially decomposed when heated in contact with air, ammonia being produced. It is also decomposed by the strong mineral acids as well as by chlorine, yielding coloured compounds.—Ed.]

Conia is characterized by its liquidity at ordinary temperatures, its volatility, its peculiar odour, its reddening turmeric paper, its vapour forming white fumes (*hydrochlorate of conia*) with the vapour of hydrochloric acid, its solution in water forming, with infusion of nutgalls, a white precipitate (*tannate of conia*), its sulphate and other salts being deliquescent and soluble in alcohol, its not being reddened by either nitric or iodic acids, and lastly, by its alcoholic solution not being precipitated by the alcoholic solution of carbazotic acid. Several of the *salts of conia* are crystallizable. When solutions of them are evaporated, they lose a part of their base, the odour of which becomes sensible. The nitrate of conia, when decomposed by heat, yields brown pyrogenous products. The solution of hydrochlorate, when evaporated in air, becomes

¹ *Dict. de Mat. Méd.* ii. 391.² *Mag. für Pharm.* xxxv. 75 and 259.³ *Trans. R. y. Soc. Edinb.* vol. xlii.; and *Lond. Med. Gaz.* xviii. 123.⁴ *Journ. de Chim. M. d. t.* ii. 2nde sér. p. 530.⁵ *Journ. de Pharm.* xlii. 366.

first purple, then deep blue. Potash added to a salt of conia sets the base free, which is then recognized by its odour.

Liebig analyzed conia. Its constituents are:—

	Atoms.	Eq. Wt.	Per Cent.	Liebig.
Carbon	12	72	66.67	66.913
Hydrogen	14	14	12.96	12.000
Nitrogen	1	14	12.96	12.805
Oxygen	1	8	7.41	8.282
Conia	1	108	100.00	100.000

But, according to Artigosa, its formula is $C^{16}H^{16}N$.

The effects of conia have been tried on mammals (the dog, cat, rabbit, and mouse), birds (pigeon, kite, and sparrow), reptiles (slow-worm), amphibials (the frog), annelides (earth-worm), and insects (fly and flea). One drop placed in the eye of a rabbit killed it in nine minutes; three drops employed in the same way killed a strong cat in a minute and a half; five drops poured into the throat of a small dog began to act in thirty seconds, and in as many more motion and respiration had entirely ceased. [It does not dilate the pupil.—Ed.]

The following are the symptoms produced, as detailed by Dr. Christison: "It is, in the first place, a local irritant. It has an acrid taste; when dropped into the eye, or on the peritoneum, it causes redness or vascularity; and to whatever texture or part it is applied, expressions of pain are immediately excited. But these local effects are soon overwhelmed by the indirect or remote action which speedily follows. This consists essentially of swiftly-spreading palsy of the muscles, affecting first those of voluntary motion, then the respiratory muscles of the chest and abdomen, lastly, the diaphragm, and thus ending in death by asphyxia." Convulsive tremors, and twitches of the limbs, sometimes, though not invariably, are observed. The external senses do not appear to be affected until respiration is impaired. If a rabbit be lifted up by his ears when under the influence of the poison, he makes the same kind of struggles to be released that he does when in health. So also, if we place him in an uneasy posture, he makes attempts to alter his position, proving that his senses are unimpaired. After death, the muscles are susceptible of the galvanic influence. MM. Boutrou-Charlard and O. Henry state, that most of the animals to whom they gave conia became "a prey to the most dreadful convulsions. The plaintive cries, the contortions, and the rigidity of the limbs, which have always, preceded death, leave no doubt as to the cruel pains which this kind of poisoning brings on." This account agrees neither with my own observations, nor with those published by Dr. Christison.

Does conia become absorbed? In favour of the affirmative view of this question may be mentioned the fact, that this alkali acts on all the textures admitting of absorption; and that the quickness with which the effects occur are in proportion to the absorbing power of the part. But the rapidity of its action, when introduced into the veins, is a barrier to the supposition of its acting on the nervous centres by local contact; for Dr. Christison states, that two drops, neutralized by dilute muriatic acid, and injected into the femoral vein of a young dog, killed the animal in two or three seconds at farthest.

The primary seat of the action of conia is probably the spinal cord. In this, conia and strychnia agree; but in the nature of the effect they seem, as Dr. Christison has observed, to be the counterparts of each other. Conia exhausts the nervous energy of the cord, and causes muscular paralysis; strychnia irritates it, and produces permanent spasm of the respiratory muscles. It is evident, therefore, that, like strychnia and nux-vomica, its operation is on the seat of the reflex functions, which, according to Mr. Grainger,¹ is the gray matter of the spinal cord.

These effects of conia suggest its employment in convulsive or spasmodic diseases; as tetanus, poisoning by strychnia, brucia, or nux-vomica, hydrophobia, &c. I have tried it on two rabbits under the influence of strychnia, and found that it stopped the convulsions, but hastened rather than prevented death. In September, 1838, it was tried in a case of hydrophobia at the London Hospital. The following is a brief report of the case: "In the case of hydrophobia, in a middle-aged man, after the disease was fully formed, two minims of conia, dissolved in thirty drops of acetic acid, were applied endermically to the præcordium (the cuticle being previously removed by a blister). The effects were instantaneous. The pulse fell from 64 to 46, and became more regular. The vomiting and convulsions ceased; the respiration became less difficult, and the symptoms of the disease appeared to be altogether mitigated. The man expressed himself as feeling much better, and entertaining hopes of an ultimate recovery. These effects were, however, but transitory, and in about seven minutes the symptoms began to reappear, and shortly assumed their previous urgency. Three minims of conia were injected into the rectum about a quarter of an hour after the endermic application of it, but it produced no effect in allaying the symptoms of the disease. The remedy was not repeated, and the man became

¹ *Observations on the Struct. and Funct. of the Spinal Cord.*

rapidly worse, and died in a few hours." The properties of conicine have been recently examined by Orfila.¹

3. EMPYREUMATIC OIL OF HEMLOCK. (*Pyro-conia*?).—This oil, obtained by the destructive distillation of hemlock, resembles, according to Dr. Morries,² that procured from foxglove.

CHARACTERISTICS FOR MEDICO-LEGAL PURPOSES.—Hemlock can only be properly recognized by its botanical characters, already described; yet its remarkable odour may sometimes be of considerable assistance in recognizing the plant or its preparations; nor is the fact to be lost sight of, that a solution of potash rubbed with the leaves or fruit develops a strong smell of conia. In some cases it might be possible to obtain conia by distilling the alcoholic extract of the suspected substance with water and caustic potash.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Marcet placed a haricot plant (*Phaseolus vulgaris*) in a solution of five grains of the extract of hemlock. In a few minutes the two lower leaves curled at their extremities; the next day they were yellow, and subsequently died.³ Schübler and Zeller⁴ also confirm its poisonous operation.

β. On Animals generally.—The effects of hemlock on animals have been tried by Harder,⁵ Wepfer,⁶ Orfila,⁷ and Schubarth.⁸ The animals experimented on were the dog, wolf, rabbit, and guinea-pig. The action of hemlock on the solipedes and ruminants is very much less energetic than on the carnivora. Moiroud⁹ has given three pounds and a half of the plant to a young horse, without inconvenience; but in another instance the decoction of four ounces proved fatal. It caused dejection, stupor, dilatation of the pupils, trembling, salivation, nausea, spasmodic contraction of the muscles of the extremities, rolling of the eye, grinding of the teeth, and copious cold sweats. From the observations of Orfila, hemlock is a local irritant (though this action was not constantly observed), and produces giddiness, convulsions, loss of sensibility, palsy, and coma. This account, as Dr. Christison observes, does not agree with the symptoms induced by conia, which does not seem to affect the senses so long as the respiration goes on. "But it is possible," he adds, "that the difference is more apparent than real, and that hemlock has been supposed to extinguish sensation, merely because by inducing paralysis it takes away the power of expression; at least, in some experiments I have made, sensation did not appear to be affected; and the whole phenomena were identical with those produced by conia. In these experiments, I used very strong extracts, prepared by absolute alcohol from the fresh leaves or full-grown seeds; and each of them occasioned, in doses of thirty grains or thereabouts, paralysis of the voluntary muscles, with occasional slight convulsions, then paralysis of the respiratory muscles of the chest and abdomen, and finally cessation of the action of the diaphragm. Sensation appeared to continue so long as it was practicable to make an observation on the subject; and the heart contracted vigorously for a long time after death." But from the united observations of the effects of hemlock on animals and man, I cannot help suspecting, either that this plant contains a second active principle, whose operation is somewhat distinct from conia, or that the influence of this alkaloid is greatly modified in the plant by combination with other matters.

γ. On Man.—In small or medicinal doses, hemlock has been frequently administered for a considerable period, with obvious relief, in certain diseases (tumours of various kinds, for example), without any other evident effect; hence the statement of some authors, that hemlock acts insensibly on the system. "It seldom purges," says Storck,¹⁰ and very rarely vomits. Sometimes it increases perspiration, and often it occasions a copious discharge of viscid urine. In many patients, nevertheless, it does not sensibly augment any of the secretions." Long-continued use, especially if the doses be increased, will sometimes occasion disorder

¹ See his paper in *Annales d'Hygiène*, 1851, ii. p. 147.

² *Ann. Chim. et Phys.* xxix. 219.

³ *Bonnet, Spéc. chér.* l. iv. sect. x. obs. iv. p. 488.

⁴ *Toxicol. Gén.* ii.

⁵ *Pharm. Vét.* 359.

⁶ *Ed. Med. and Surg. Journal*, xxxix. 377.

⁷ *Schweigger's Journ. f. d. Chem.* Bd. i. S. 54.

⁸ *Hist. Cicut. aquat.* p. 201. 1733.

⁹ *Vibmer, Wir. d. Arzneim. u. Gifte*, ii. 169.

¹⁰ *Essay on Hemlock*, Eng. tr. 2d edit. 1762.

of the digestive organs or of the nervous system, dryness of the throat, thirst, and occasionally, it is said, an eruption on the skin. Choquet¹ mentions the case of a man who gradually increased the dose of the extract to half a drachm; it produced slight delirium and syncope, which obliged him to suspend its use. The ancients were of opinion that hemlock exercised a specific influence over the breasts and testicles. "It extinguishes the milk," says Dioscorides, "and prevents the development of the mammæ of virgins; moreover, in boys, it causes wasting of the testicles." Pliny gives a similar account of it, and adds, "it reduces all tumours." The same notions of its effects seem to have been entertained by the Arabians; for Avicenna praises it as a remedy for tumours of the breasts and testicles. More recently,² somewhat similar effects on the breasts have been ascribed to it. In two cases it is said to have caused atrophy of the mammæ.

In *large* or *poisonous doses*, the symptoms are those indicating disorder of the cerebro-spinal functions. In some of the best recorded cases the leading symptom was coma; the effects being altogether analogous to those of opium. In other instances, convulsions, or violent delirium, or both, were the prominent symptoms. As an illustration of the *comatose condition* sometimes brought on by this poison, I shall quote a case recorded by M. Haaf, a French army surgeon, and which occurred to him while in garrison at Torrequemada, in Spain, in March, 1812.³ A soldier having eaten of some broth into which hemlock had been put, went to sleep immediately after his supper. In an hour and a half he was found groaning and breathing with difficulty; in consequence of which M. Haaf was sent for. He found his patient in a profound sleep, without sense, respiring with difficulty, and lying on the ground. His pulse was 30, small, and hard; the extremities cold; the face bluish, and distended with blood, like that of a person strangled. Twelve grains of emetic tartar were given, and occasioned some fruitless attempts to vomit. He became gradually worse, had violent palpitations of the heart, and died in three hours after his fatal supper. Several other cases in which *coma* was the leading symptom might be quoted, but the one just related is the best.

We have no well-detailed cases in which *delirium* was the leading symptom. The following must suffice, by way of illustration; it is from Kircher.⁴ Two priests ate hemlock root by mistake; they became raving mad, and mistaking themselves for geese, plunged into the water. For three years they suffered with partial palsy and violent pain. Orfila also mentions a vine-dresser and his wife, who became mad and furious from hemlock.

General *paralysis* has also been observed in this form of poisoning. A case in which this was a most prominent symptom is mentioned by Alderson.⁵ An overdose of *Conium maculatum* "produced general paralysis; the under jaw fell, the saliva ran from the patient's mouth, the urine dropped from the bladder, and the contents of the rectum were discharged; in short, every voluntary muscle lost its energy, and the patient continued for nearly an hour in this most deplorable state, unable to move or to command the slightest exertion, though all the time perfectly sensible." He recovered by the use of stimulants.

As illustrations of the *convulsions* caused by hemlock, I may refer to the cases mentioned by Limpricht and Ehrhard.⁶ The first states that an old woman suffered for three months with abdominal pain and convulsive movements of the limbs, in consequence of eating hemlock root. Ehrhard mentions trismus as one of the symptoms in another case. Dr. Watson⁷ has related two cases in which giddiness, coma, and convulsions occurred. These statements, as well as others of a like tendency which might be quoted, do not agree with the (as yet ascertained) effects of conia.

The *post-mortem* appearances throw but little light on the *modus operandi* of

¹ Orfila, *Toxicol. Gén.* ii. (not mentioned in later editions.—Ed.)

² Orfila, *Toxicol. Gén.* ii. p. 426, ed. 1843.

³ *An Essay on the Rhus Toxicodendron*, p. vi. Hull, 1811.

⁴ *Phil. Trans.* vol. xliii. No. 473, p. 18.

⁵ *Lond. Med. Gaz.* viii. 125.

⁶ Wibmer, *Wirk. &c.* ii. 172.

⁷ Wibmer, *op. cit.*

hemlock. Venous congestion, especially of the cerebral vessels, a fluid condition of the blood, and, in the lower animals, redness of the alimentary canal, are the occasional appearances.

USES.—In the present state of uncertainty with respect to the real physiological operation of hemlock, it is obviously impossible to lay down indications or contra-indications for its use, which can be much relied on. Acute inflammation, fever, apoplexy, or tendency to it, and paralysis, are among the circumstances which oppose the employment of hemlock.

The uses of hemlock may be reduced to two heads: those which depend on its influence over the organic functions; and, secondly, those which have reference to its influence over the cerebro-spinal system. The resolvent or discutient and alterative uses come under the first head; the antispasmodic and anodyne under the second.

1. *As a resolvent or discutient and alterative.*—Under the continued use of small and repeated doses of hemlock, glandular and visceral enlargements have frequently subsided; hence has arisen the opinion, entertained in all ages, of the resolvent and discutient powers of this remedy, and of the stimulus which it communicates to the absorbing vessels. The mammæ and the skin are the parts in which these powers have been supposed to be more especially manifested; and the asserted effects (wasting of the breast, profuse sweating, and eruptions) of hemlock on these parts, in healthy individuals, lend support to this opinion. But the influence of hemlock over the organic functions does not appear to be limited to this resolvent operation. In foul ulcers, the quality of the discharge has been greatly improved, while pain has been alleviated, and the tendency of the sores to spread has apparently been greatly diminished. If, then, these effects be really referable to hemlock (and they have been asserted by so many writers, in all ages, that we can scarcely refuse to admit them), they prove that this plant exercises a most profound influence over nutrition and the other organic functions, and which we have no better term to indicate than that of alterative. But so frequently has this influence failed to manifest itself, especially in those cases where it was most desired, that a very proper doubt has prevailed among practitioners of the present day, whether it really exists, and whether those phenomena which have been supposed to indicate it, are not really referable to other influences and circumstances. That hemlock has some influence of the kind referred to, I do not doubt; but it has been greatly exaggerated, and thereby much unmerited discredit has been brought on the remedy; for practitioners, finding that it would not do all that had been ascribed to it, have frequently dismissed it as altogether useless. Whether the failures ought, in part at least, to be ascribed to imperfect modes of preparing and administering this plant, we are, as yet, unable positively to affirm. One fact, however, is certain, that many of the preparations of hemlock in ordinary cases are inert, or nearly so; and others, probably, have had their properties greatly changed in the process of their preparation. The remark made by Dr. Christison, with respect to the physiological effects of this plant, applies well to the point under discussion. "If," says this writer, "physicians or physiologists would acquire definite information as to the physiological effects of hemlock, in small or medicinal doses, they must begin the inquiry anew. Little importance can be attached to anything already done in this field, as I have no doubt whatever that by far the greater proportion of the preparations of hemlock hitherto employed have been of very little energy, and, in the doses commonly used, are absolutely inert."

The diseases to which the preceding remarks especially apply, are, *enlargements and indurations of the absorbing and secreting glands and of the viscera, scrofula, obstinate chronic skin diseases, and foul ulcers*. I am not prepared to offer any opinion, as to whether the diseases to which the terms *scirrhus* and *cancer* are strictly applicable, have ever been cured by hemlock. One fact is undoubted, that diseases, supposed to have been scirrhus and cancerous, have been greatly alleviated, and in some cases, apparently cured by this remedy. This fact does not

rest on the sole testimony of Storek,¹ but on that of a multitude of practitioners.² Bayle has collected, from various writers, forty-six cases of cancerous diseases, said to have been cured, and twenty-eight ameliorated, by hemlock. In *scrofula*, in which disease Fothergill,³ and many others,⁴ have praised it, it seems to be occasionally useful as a palliative in irritable constitutions. It allays the pain, and assists in reducing the volume of enlarged lymphatic glands, and in scrofulous ulcerations improves the quality of the discharge, and disposes the sores to heal. Even *enlargements of the liver, spleen, and pancreas*, have been, at times, apparently, benefited by hemlock. In *mammary tumours* and *profuse secretion of milk (galactorrhœa)*, a trial of it should never be omitted. In *bronchocele* it, has been found efficacious by Dr. Gibson, Professor of Surgery in the University of Pennsylvania.⁵ In *sypilis* it is useful, by alleviating nocturnal pains, and in diminishing the tendency to spread of irritable sores.⁶ In *chronic skin diseases* (lepra, herpes, &c.) it is now but rarely employed.

2. As a *cerebro-spinal agent (antispasmodic and anodyne)*.—The power possessed by conia of paralyzing the motor nerves, suggests the employment of hemlock as an *antispasmodic*. Hitherto, however, trials of it have been made in a few spasmodic diseases only, and those have not proved favourable to its reputation. In some spasmodic affections of the respiratory organs it has gained a temporary celebrity only. In *whooping-cough*, Dr. Butter⁷ spoke favourably of it, as having the advantage over opium of not being liable to check expectoration. But though the violent and periodic fits of coughing are obviously of a spasmodic nature, and, therefore, apparently adapted for the use of hemlock, experience has fully proved that the disease is one which will run through a certain course. At the best, therefore, hemlock can prove a palliative only. In other forms of *spasmodic cough*, as well as in *spasmodic asthma*, hemlock deserves farther trial. In *tetanus*, conia or hemlock held out some hopes of doing good. Mr. Curling has kindly furnished me with the notes of a case which occurred in the London Hospital. A tincture of hemlock seeds was exhibited on the eighth day of the disease, at first in doses of ℥xx every hour, which were increased in the course of the three following days to fʒij every quarter of an hour, until the patient (a man aged 46) had taken, in all, two pints! but without any decided effect on the spasms or brain. Morphia and laudanum were afterwards used, but the man died. A small quantity of conia, obtained from three ounces of the same tincture used in this case, killed a cat in less than four minutes. In a case of *chorea*, treated by Mr. Curling, no relief was obtained by the use of the above-mentioned tincture, given to the extent of three ounces in twelve hours. The patient (a young man) ultimately died, exhausted from the long-continued and violent convulsions of nearly all the voluntary muscles.

Hemlock has been frequently employed as an *anodyne*, and often with apparent relief. As, however, conia does not appear to have the same paralyzing influence over the sensitive, that it has over the motor nerves, some doubt has been raised on the real anodyne influence of hemlock. However, in *tender glandular enlargements, in painful ulcers, in scirrhus and cancer, in rheumatism, and in neuralgia*, hemlock, has, at times, evidently mitigated pain; and its power of *allaying troublesome cough*, is, in some instances, referable to its diminishing the preternatural sensibility of the bronchial membrane.

Anaphrodisiac properties have been ascribed to hemlock, and hence this remedy has been used in *nymphomania* and *satyriasis*.

ADMINISTRATION.—Hemlock is used in the form of *powder, tincture, extract, ointment, and poultice*.

ANTIDOTES.—No chemical antidote is known for hemlock, though it is not im-

¹ *Essay on the Med. Nat. of Hemlock* [English transl.], 2d edit. 1762.

² See Bayle, *Bibl. Thérap.* iii. 618.

³ See Bayle, *op. cit.*

⁴ Pearson, *Obs. on the Effects of Var. Art. of the Mat. Med. in Lues Venerea*, p. 62, 1600.

⁵ *Treat. on the Kink-cough*, 1773.

⁶ *Med. Obs. and Inq.* iii. 400.

⁷ *United States Dispensatory*.

probable that an infusion of galls might be serviceable, as mentioned for *conia*. The first object, therefore, is to evacuate the poison from the stomach; this is to be effected by the same means as directed for poisoning by opium. If the poison be suspected to have passed into the bowels, a purgative is to be administered, unless diarrhœa have come on. The subsequent treatment will depend on the symptoms; blood-letting is frequently required, to relieve the congested state of the cerebral vessels. Opium is generally prejudicial. Artificial respiration should not be omitted in extreme cases. As strychnia and nux-vomica appear to produce a condition of the spinal cord opposite to that of *conia*, it is a question whether either of these agents might not be serviceable in the treatment of a case of poisoning by hemlock.

1. **PULVIS CONII; Powder of Hemlock.**—The powder, when properly prepared from the leaves, has the peculiar odour of the plant, and a fine green colour; but neither the odour nor the colour are absolutely indicative of activity. The test of the presence of *conia* is caustic potash, and, as the *Edinburgh College* properly observes, “the powder, triturated with aqua potassæ, exhales a powerful odour of *conia*.” But the odour of the volatile oil of the plant being very analogous to that of *conia*, creates some difficulty with inexperienced persons. The vapour of *conia*, evolved from powdered hemlock by potash, fumes with hydrochloric acid; but the same occurs with ammonia, set free by the same agent. As the powder, however well prepared, quickly spoils by keeping, it is not a preparation which deserves confidence, and should never be used if it have been kept beyond the year. The dose of it is three or four grains twice or thrice daily, the quantity being gradually increased until some obvious effect (nausea, dryness of the throat, giddiness, headache, or disordered vision) in the system is produced. As different parcels of the powder possess very unequal powers, it is necessary, when changing the parcels, to recommence with small doses. I have elsewhere referred to the observation of Geiger, as to the small quantity, or even entire absence, of *conia*, in the dried leaves of hemlock.

2. **TINCTURA CONII, L. E. [U. S.]; Tincture of Hemlock.**—(Hemlock Leaves, dried, \bar{z} v; Proof Spirit Oij. Macerate for seven days and strain, *L.* The formula of the *Edinburgh College* is as follows: “Fresh Leaves of Conium \bar{z} xij; Tincture of Cardamom Oss; Rectified Spirit Oiss. Bruise the hemlock leaves, and express the juice strongly; bruise the residuum, pack it firmly in a percolator; transmit first the tincture of cardamom, and then the rectified spirit, allowing the spirituous liquors to mix with the expressed juice as they pass through; add gently water enough to the percolator for pushing through the spirit remaining in the residuum. Filter the liquor after agitation.”)—The process of the *Edinburgh College* yields a much more energetic preparation than that of the *London College*, as it obviates the necessity of drying the leaves, and, therefore, much deserves the preference. If, however, the percolation were dispensed with, and the tincture prepared merely by adding spirit (not tincture of cardamom) to the expressed juice, the process would be greatly improved. If the leaves have been sufficiently pressed, the percolation is scarcely necessary, and, therefore, only adds to the labour and expense of the process. Any active matter lost by omitting percolation, may be easily compensated by increasing the quantity of juice employed, the cost of which scarcely deserves notice. The employment of tincture of cardamom is objectionable, since it prevents the apothecary from forming a judgment of the colour, taste, and smell of, and the effect of potash on, this preparation; hence, in the *London tincture* it has been judiciously omitted. And lastly, if the percolation process be adopted, surely the directions of the *Edinburgh College* are too loose. The quantity of water which is to be employed “for pushing through the spirit” should be accurately defined, or it will be impossible to have preparations made at different times, and by different persons, of uniform strength. Good tincture of hemlock should evolve a strong odour of *conia* on the addition of potash. In 1837,¹ I recommended the use of

¹ *London Med. Gaz.* xix. 770.

an alcoholic tincture of the bruised fruit. More recently, Dr. Osborne¹ has advised the same. *Tinctura conii*, L. is given in doses of fʒss or fʒj, which are to be gradually increased until some effect is produced. *Tinctura conii*, E. must be employed more cautiously; though the quantity of hemlock leaves used by the Edinburgh College would, if dried, be scarcely half that employed by the London College (as 1000 parts of the fresh leaves yield only 185 parts when dried, according to Henry and Guibourt).² The drying, however, as I have already noticed, greatly deteriorates the activity of the leaves.

[The U. S. Pharm. directs Hemlock Leaves ʒiv, Diluted Alcohol Oij.]

Succus Conii; *Preserved Juice of Hemlock*.—The method of preparing the preserved vegetable juices has been described. Mr. Bentley informs me that, from 1 cwt. of hemlock leaves gathered in May, he procured twelve imperial quarts of juice. The preserved juice of hemlock appears to me to be an excellent preparation.

3. EXTRACTUM CONII, L. E. D. [U. S.] (*Succus spissatus Conii*, D.); *Extract of Hemlock*.—(The London College directs this extract to be prepared in the same manner as Extract of Aconite; viz. Fresh Hemlock Leaves lbj; bruise in a stone mortar; then press out the juice and evaporate it undefecated to a proper consistence; and the Dublin College adopts a method of preparation the same as that for Extractum Belladonnæ. The following are the directions of the Edinburgh College: "Take of Conium any convenient quantity, beat it into a uniform pulp in a marble mortar, express the juice, and filter it. Let this juice be evaporated to the consistence of a very firm extract, either in a vacuum with the aid of heat, or spontaneously in shallow vessels exposed to a strong current of air freed of dust by gauze screens. This extract is of good quality only when a very strong odour of conia is disengaged by degrees, on its being carefully triturated with aqua potassæ.")—Most of the extract of the shops is inert, or nearly so. "We were one day," says Orfila,³ "in the shop of an apothecary, who had several times furnished us with the extract of hemlock, which we had administered to dogs in the dose of ten drachms, without producing any serious accident. We endeavoured to prove to him that the medicine was badly prepared; and, in order to convince him effectually, we swallowed, in the presence of several persons who happened to be in his shop, a drachm of this extract (seventy-two grains) dissolved in two drachms of water. We felt no effect from it, whilst twenty or thirty grains of the extract, well prepared, would have probably proved fatal to us. Let it be conceived now what advantage a person is likely to derive from such an extract, who takes one or two grains of it per day, or even thirty or forty, with the hope of getting rid of a scirrhous tumour, or of any other disease."

The extract of hemlock contains very little conia; this has been shown by Geiber and Christison, and has been verified by myself. From ʒiv. of extract, procured from one of the most respectable drug houses in town, I was unable to procure any sensible quantity of this alkali. "From what has come under my own observation," says Dr. Christison, "the extracts of hemlock may become feeble, if not inert, in one of two ways—either by the heat being continued after the concentration has been carried to a certain extent, or by long keeping. On the one hand, I have always observed that, from the point at which the extract attains the consistence of thin syrup, ammonia begins to be given off in abundance, together with a modified odour of conia; and, on the other hand, I have found extracts, which were unquestionably well prepared at first, entirely destitute of conia in a few years—a remark which applies even to the superior extract prepared by Mr. Barry, of London, by evaporation *in vacuo*."

Mr. Brande⁴ observes that "the most active extract is that which is procured by moderate pressure from the leaves only; when the stalks and stems are used and violent pressure employed, the extract is glutinous, dark-coloured, and viscid, and less active than in the former case, when it has a somewhat mealy consistency, and

¹ *Dub. Journ.* xvi. 469.

² *Toxicol. Gén.* ii.

³ *Pharm. Raison.* i. 27.

⁴ *Dict. of Pharm.* 195.

an olive-green colour. With every caution, however, on the part of the operator, the colour, odour, and efficacy of extract of hemlock will vary with the season, and with the situation and soil in which the herb has grown. The best method of preparing this and similar extracts consists in gradually heating the expressed juice to a temperature of about 212° [by which the vegetable albumen is coagulated, and retains, mechanically or chemically, a portion of the active principle], then to suffer it to cool, to strain it through moderately fine linen, and evaporate the strained liquor, and when it has nearly acquired a proper consistency, to add the matter which remained upon the strainer." One cwt. of hemlock yields from three to five lbs. of extract. If ammonia be evolved during the preparation of the extract, we may infer that a decomposition of the conia is going on. However carefully extract of hemlock may be prepared, I prefer for medicinal use the tincture made with the expressed juice as before stated. The dose of the extract should, at the commencement, be two or three grains, and gradually increased to five grains, or until some obvious effect is produced. [The goodness of the extract may be determined by the disengagement of a strong odour of conia when it is gradually triturated with Liquor Potassæ.—Ed.]

[The U. S. Pharm. also directs the *Extractum Conii Alcoholicum*, made in the way directed for the same Extract of Belladonna (see page 477).]

4. *PILULÆ CONII COMPOSITÆ*, L.; *Compound Pills of Hemlock*.—(Extract of Hemlock $\mathfrak{z}\text{v}$; Ipecacuanha, powdered, $\mathfrak{z}\text{j}$; Treacle, as much as may be sufficient. Beat them together until incorporated.)—Antispasmodic, slightly narcotic, and expectorant. Used in spasmodic coughs, bronchitis, and the incipient stage of phthisis.—Dose, grs. v to grs. x twice or thrice daily. [In this preparation, the London College has substituted treacle for a solution of gum.—Ed.]

5. *UNGUENTUM CONII*, L.; *Hemlock Ointment*.—(Fresh Leaves of Hemlock, Prepared Hogslard, of each lbj . Boil the leaves in the lard until they become crisp, then express through linen.)—It is employed as an anodyne application to foul, painful, and cancerous sores, to glandular and scirrhus swellings, and to painful piles. An extemporaneous substitute may be prepared with lard and the extract of hemlock.

6. *CATAPLASMA CONII*, L.; *Hemlock Poultice*.—(Extract of Hemlock $\mathfrak{z}\text{j}$; Boiling Water $\mathfrak{z}\text{x}$; Powdered Linseed $\mathfrak{z}\text{ivss}$. Add the linseed gradually to the water, constantly stirring to make a cataplasm. On this spread the extract, first softened with water.)—A poultice of hemlock is sometimes employed as a soothing anodyne application to cancerous, scrofulous, venereal, and other foul ulcers. It is sometimes prepared with the unstrained decoction and bruised meal; occasionally, the bruised leaves, or the dried herb with hot water, are used. *Hemlock fomentation* (*fotus conii*) is sometimes applied to painful swellings. It is prepared with the herb (fresh, when it can be procured) and hot water.

OTHER UMBELLIFERÆ, DIETETICAL OR POISONOUS.

All the more important medicinal Umbelliferæ have been noticed. It remains now to enumerate those plants in common use for dietetical purposes, or which are indigenous and poisonous.

Of the DIETETICAL UMBELLIFERÆ several have been already mentioned. To these may be added Parsley (*Petroselinum sativum*) and Chervil (*Anthriscus Cerefolium*), used as pot-herbs and garnishings; the Parsnip (*Pastinaca sativa*) and Skirret (*Sium Sisarum*), employed on account of their esculent roots; Celery (*Apium graveolens*), an acetarious plant, the blanched leaf-stalks of which are eaten raw as a salad; Common Samphire (*Crithmum maritimum*), which is pickled; Eryngo (*Eryngium campestre*), the root of which is preserved, and eaten as a candy (*Candied Eryngo*; *Radic Eryngii condita*); and Lovage (*Levisticum officinale*), used by distillers for preparing a liquor termed *lovage*.

The POISONOUS INDIGENOUS UMBELLIFERÆ are acro-narcotics. When swallowed, they cause gastric irritation, giddiness, delirium, convulsions, and coma. The most important (after *Comum maculatum*, before mentioned), are Fool's Parsley (*Æthusa Cynapium*), which contains a pecu-

liar alkaloid called *cynapina*; Hemlock Water-dropwort (*Enanthe crocata*); Celery-leaved Water-dropwort (*Enanthe apifolia*); and Water Hemlock (*Cicuta virosa*).

ORDER LVII.—CUCURBITACEÆ, *Jussieu*.—THE GOURD TRIBE.

CHARACTERS.—*Flowers* usually unisexual, sometimes hermaphrodite. *Calyx* 5-toothed, sometimes obsolete. *Corolla* 5-parted, scarcely distinguishable from the calyx, very cellular, with strongly marked reticulated veins, sometimes fringed. *Stamens* 5, either distinct or cohering in 3 parcels; *anthers* 2-celled, very long and sinuous. *Ovary* inferior 1 celled, with 3 parietal placentæ; *style* short; *stigmas* very thick, velvety, or fringed. *Fruit* fleshy, more or less succulent [occasionally dry, opening by valves], crowned by the scar of the calyx, 1-celled [in some *Momordica*s 3- or 4-celled], with three parietal placentæ. *Seeds* flat, ovate, enveloped in an aril, which is either juicy or dry and membranous; *testa* coriaceous, often thick at the margin; *embryo* flat, with no *albumen*; *cotyledons* foliaceous, veined; *radicle* next the hilum.—*Roots* annual or perennial, fibrous or tuberous. *Stem* succulent, climbing by means of tendrils formed by abortive leaves (stipules, *St. Hil.*). Leaves palmated, or with palmated ribs, very succulent, covered with numerous asperities. *Flowers* white, red, or yellow (*Lindley*).

PROPERTIES—Variable; suspicious. The roots and fruits of many species are drastic cathartics. The fruits of other species are employed as articles of food.

251. CITRULLUS (*Cucumis*, Linn.) COLOCYNTHIS, *Schrad.*—THE BITTER CUCUMBER, OR COLOCYNTH.

Sex. Syst. Monœcia, Syngenesia.¹

(Fructus Decorticatus, L.—Pulp of the Fruit, *E.*—Fructûs pulpa, *D.*)

[Colocynthis, *U. S.*]

HISTORY.—Colocynth is supposed to be the plant termed, in the Old Testament,² the *wild vine* (literally, *the vine of the field*), whose fruit the sacred historian calls *pakkoth*, a word which in our translation is rendered *wild gourd*. To understand the passage referred to, it is to be remembered that different kinds of gourd are commonly used in the East for shredding into pottages.³ Colocynth was employed by the Greeks at a very early period. Hippocrates⁴ employed *κολοκυνθίς ἄγρια* (*cucurbita sylvestris*, or *wild gourd*) only in pessaries for bringing on menstruation. Dioscorides⁵ gives a good description of colocynth. Pliny⁶ calls it *colocynthis*.

[**BOTANY.** *Gen. Char.*—*Corolla* persistent, quinquepartite, roundish. *Anthers* triadelphous and bilocular. *Style* trifid. *Stigmas* obcordate, convex. *Fruit* fleshy (peponida) many-seeded (*Arnott*).⁷—*Ed.*]

Sp. Char.—*Stem* procumbent, somewhat hispid. *Leaves* cordate-ovate, many-lobed, white, with hairs beneath; the lobes obtuse; the petioles as long as the lamina. *Tendrils* short. *Flowers* axillary, solitary, stalked; *females* with the tube of the calyx globose, somewhat hispid, the limb campanulate, with narrow segments. *Petals* small. *Fruit* globose, smooth, yellow, when ripe, with a thin solid rind and a very bitter flesh. (*De Cand.*)

Root annual, white, branched. *Stems* herbaceous, angular, branched. *Leaves* bright green on the upper side, paler, and clothed with whitish hairs underneath. *Tendrils* filiform, branching, opposite each leaf. *Calyx* 5-toothed. *Corolla* yellow,

¹ The followers of Linnæus are by no means agreed with their great master, or among themselves, as to the true order of Cucumis, and some other cucurbitaceous genera. The male flowers have, apparently, three stamina; but of these, two have an anomalous structure, and are regarded by some botanists as stamina with doubly-folded anthers; by others, as being composed each of two adherent stamina. Hence some have considered the flowers to be *triandrous*, others *pentandrous*—the latter, taking into account the adhesion of the stamina, consider them to be *syngenesious*, *triadelphous* (*polyadelphous*), or *monadelphous*. So that while Linnæus adopted *Monœcia*, *Syngenesia*, as the class and order, Turton placed Cucumis in *Monœcia*, *Triandria*; Smith in *Monœcia*, *Pentandria*, or *Mon. Polyadelphia* (see his *Introd. to Botany*, 4th edit. p. 363; Willdenow, Persoon, and London, in *Monœcia*, *Monadelphia*; while Sprengel, in conformity with his modification of Linnæus's sexual system, places it in *Monadelphia*, *Monœdia*.

² 2 Kings, iv. 39.

³ Pages 263 and 265, ed. Fœrs.

⁴ *Hist. Nat.* xx. 8, ed. Valp.

⁵ *Picture Bible*, ii. 226.

⁶ *Lib.* iv. cap. 178.

⁷ *Hosker's Journal of Botany*, iii. 271.

with greenish veins. *Males: stamens* 3, short, free; two of which have doubly-bent anthers, or consist of two anthers; in which case the number of stamens is really five. *Females: ovarium* round, smooth, inferior; *style* short, cylindrical; *stigmas* 3; *filaments* without anthers. *Fruit (pepo)* about the size of an orange, with a thin but solid rind.

Hab.—Japan, the sandy lands of Coromandel, Cape of Good Hope, Syria, Nubia, Egypt, Turkey, and the islands of the Grecian Archipelago. Cultivated in Spain.

PREPARATION OF THE FRUIT.—The fruit is gathered in autumn, when ripe and yellow, and in most countries is peeled and dried, either by the sun or by stoves.

COMMERCE.—Colocynth is imported from Spain (Almeria, Gibraltar, Cadiz, and Malaga), Trieste, Smyrna, Alexandretta, and Mogadore. It comes over in cases, casks, boxes, &c. In 1839, duty (2d. per lb.) was paid on 10,417 lbs.

DESCRIPTION.—The fruit called *colocynth* or *coloquintida* (*colocynthis*; *poma colocynthidis*) is imported either *peeled* (generally), or sometimes *unpeeled*. Its *pulp (pulpa colocynthidis exsiccata)* is nearly white, inodorous, light, spongy, porous, tough, intensely and nauseously bitter. The seeds (*semina colocynthidis*) are smooth, either white or yellowish-white (*white colocynth seeds*), or brownish (*black colocynth seeds*), bitter, especially the dark-coloured ones, and inodorous. By digesting them in repeated portions of boiling water, and afterwards well washing them, the greater part of the bitterness may be extracted. Two kinds of colocynth, distinguished as *Turkey* and *Mogadore colocynth*, are known in commerce.

a. Turkey Colocynth: Peeled Colocynth.—This is imported from the Levant and Spain. The usual size of each pepo is about two or three inches in diameter; the shape is more or less globular, according to the evenness with which the rind has been removed, and the degree of contraction in drying; the colour is white, or pale yellowish white. One hundred parts by weight are said to consist of 28 parts pulp, and 72 parts seed.

β. Mogadore Colocynth: Unpeeled Colocynth.—The pepo of this kind is larger than the preceding, and is covered with a yellowish, smooth, firm rind. It is imported from Mogadore in small quantity only, and is principally used by druggists for show-bottles.

The seeds of colocynth are usually described as white, perfectly bland, and highly nutritious. Captain Lyon¹ states, they constitute an important article of food in Northern Africa. "The seeds of Cucurbitaceæ," says De Candolle,² "do not participate in the qualities of the pulp which surrounds them; they are bland, demulcent, of an oily nature, and susceptible of easily taking the form of an emulsion." These statements do not apply to Colocynth seeds of commerce, which I never found devoid of bitterness; and Hillefeld³ says a scruple of them purged a dog. Heise⁴ found them poisonous.

COMPOSITION.—In 1817, Braconnot⁵ analyzed the watery extract. The pulp was analyzed in 1818 by Meissner.⁶ Vauquelin⁷ examined the active principle.

Meissner's Analysis.

Bitter matter (<i>Colocynthin</i>)	14.4
Extractive	10.0
Bitter fixed oil	4.2
Resin insoluble in ether	13.2
Gum	9.5
Mucosin	3.0
Gummy extract (obtained from the ligneous fibre by potash)	17.0
Vegetable jelly	0.6
Phosphate of lime and magnesia	5.7
Ligneous fibre	19.2
Water	5.0
Colocynth Pulp	101.8

Braconnot's Analysis.

Bitter matter (<i>Colocynthin</i>), with some resin	41.4
Resin	4.3
Vegetable jelly (<i>pectin</i>)	18.6
Azotic matter	21.4
Acetate of potash	5.7
Deliquescent salt of potash not soluble in alcohol	7.1
Watery Extract of Colocynth	98.5

¹ Duncan, *Edinb. Dispens.*

² Marx, *Lehre v. d. Giften*, ii. 27

³ *Journ. de Phys.* lxxxiv. 337.

⁴ *Journ. de Pharm.* x 416

⁵ *Essai sur les Prop. Méd. des Plantes*, 191.

⁶ *Ibid.* 34.

⁷ Pfaff's *Syst. d. Mat. Méd.* vi. 365.

COLOCYNTH: *Colocynthis*: Bitter or Purgative Principle of *Colocynth*.—By digesting the watery extract of colocynth in alcohol, and evaporating the tincture thus procured, we obtain a mass, composed, according to Vauquelin, of a bitter principle and acetate of potash. A little water readily dissolves the latter, leaving the bitter resinoid matter, to which the name of *Colocynthin* has been applied. It is a yellowish brown, translucent, brittle substance, dissolving in water, but much more readily in alcohol. The aqueous solution is precipitated by the tincture of galls, and by some metallic solutions (proto-sulphate of iron, sulphate of copper, and nitrate of mercury). [This latter effect is owing, however, to the colocynth not being pure; as Mr. Wm. Bastie has shown that, when quite pure from foreign matters, it possesses neither basic nor acid properties. It appears also, from the experiments of the same gentleman, that colocynthin is oxidized by digestion with nitric acid, and a substance formed having weak acid properties, for which he proposes the name of colocynthic acid.¹—Ed.]

CHEMICAL CHARACTERISTICS.—The cold infusion is pale yellow, and very bitter; nitrate of mercury, sulphate of copper, and acetate of lead, cause in it gelatinous-flocculent precipitates (*pectates*?) ; sesquichloride of iron and tincture of nutgalls do not render it turbid. Powdered colocynth gives scarcely any evidence of the presence of starch, on mixing it with tincture of iodine and water.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—The animals on whom the action of colocynth has been examined are horses, dogs, sheep, and pigs. On dogs its operation appears to be analogous to that on man. Thus, Viborg² states that two drachms caused in a dog violent vomiting and purging; and Orfila³ has shown that three drachms introduced into the stomach (the œsophagus being tied) are capable of causing death. It is remarkable, however, that its operation on horses is comparatively slight, at least according to the testimony of Viborg, Bourgelat, and Moiroud.⁴ The last-mentioned writer says he has given four drachms to a horse without exciting the least disorder; and he adds that another cucurbitaceous plant (bryony) has likewise very little effect on the horse.

β. On Man.—Thunberg⁵ tells us that, at the Cape of Good Hope, the colocynth fruit is said to be eaten when pickled, both by the natives and colonists, although it is very bitter. Mr. Dunsterville, Surgeon, of Algoa Bay, formerly one of my pupils, tells me that the colocynth growing there does not possess the least bitterness. This may not be the medicinal plant.

Colocynth taken in *small or moderate doses* acts as a very safe and useful purgative. Its operation is not limited to the acceleration of the vermicular movements, but is extended to the secreting and exhaling vessels of the alimentary canal, whose functions it promotes. Moreover, it stimulates the other abdominal organs; and after the absorption of its bitter acrid principle, it not unfrequently proves diuretic. In *full doses*, it operates as a very active or drastic cathartic and hydragogue; but I have never seen any ill effects from its use. These remarks apply to the compound extract, the only preparation of colocynth of which I have personal experience. It would appear, partly from observation in the human subject, and also from the experiments of Orfila on dogs, that colocynth is one of those purgatives which exert a specific stimulant influence over the large intestines. In *excessive doses*, colocynth, both in powder and decoction, has on several occasions operated as a mortal poison, causing violent vomiting and purging, griping pain, and other symptoms of gastrointestinal inflammation. A teaspoonful and a half of the powder (about 3iiss) has proved fatal.⁶ In a case related by Orfila,⁷ there were, besides the preceding symptoms, dimness of sight and slight delirium. In M. Carron d'Annecy's case,⁸ the purging was followed by extreme tension and tenderness of belly, suppression of stools and urine, retraction of the testicles, and priapism. On a *post-mortem* examination there were found, besides the usual evidences of inflammation of the bowels, traces of inflammation of the liver, kidneys, and the bladder.

Considered in relation to other cathartics, colocynth will be found to rank near gamboge, from which it is distinguished by at least two circumstances; first, its

¹ *Pharmaceutical Transactions*, x. 239.

² *Toxicol. Gén.*

³ *Travels*, ii. 171.

⁴ *Toxicol. Gén.*

⁵ Wilmner, *Wirk. d. Arzneim. u. Gifte*, ii. 230.

⁶ *Pharm. Vét.* 271.

⁷ Christison, *On Poisons*.

⁸ *Ibid.*

cathartic effect is not the mere result of its topical acrid operation, but, in part, of its specific influence over the bowels; secondly, its action on the large intestine is more manifest than that of gamboge. In the latter property, colocynth approximates to aloes; but while it greatly exceeds the latter in its cathartic and hydragogue effects, it is devoid of the tonic influence possessed by aloes, when used in small doses.

USES.—Besides being useful as an ordinary purgative, colocynth is adapted for acting as a stimulus to the abdominal and pelvic vessels and nerves in cases of torpor or inactivity, and on the principle of counter-irritation already explained for determining from other organs. The objections to its use are acute inflammatory affections of the alimentary canal, diseases of the large intestine, &c. The following are the principal cases in which it is employed:—

1. *In habitual constipation.*—As an ordinary purgative for keeping the bowels regular, the compound extract of colocynth is in common use both among the public and medical men. It operates mildly, certainly, and effectually. I am acquainted with individuals who have taken this substance for years without suffering any inconvenience therefrom. The simple extract is sometimes employed as a substitute, but is less advantageous.

2. *In alvine obstruction.*—In some cases of obstinate constipation, with sickness, and other symptoms of an extremely irritable stomach, the compound extract of colocynth occasionally proves invaluable. Occupying but a small bulk, it is retained on the stomach, and succeeds in producing alvine evacuations, where the ordinary liquid purgatives fail, in consequence of being vomited up. Doubtful cases of intussusception and hernia, even with stercoraceous vomiting, I have seen completely relieved by it. More than once have I known an operation averted by its use, in those who, in addition to the above symptoms, had old herniæ, which led the surgeon to suspect strangulation. A slight degree of abdominal tenderness is not to be considered as absolutely prohibiting its use. Occasionally, the extract, is rubbed down with soap and water, and administered as an enema (see *Enema Colocynthidis*).

3. *In diseases of the brain.*—In apoplexy, or a tendency thereto, in paralysis, insanity, violent headache, &c., colocynth is sometimes employed with good effect, on the principle of revulsion or counter-irritation.

4. *In dropsy.*—In dropsical affections, colocynth has been used as a *hydragogue*. But in this country it is less frequently employed for this than for other purposes; various other hydragogues (especially elaterium and jalap) being usually preferred. It is sometimes employed as a *diuretic*, being given in the form of decoction. Hufeland regarded it as a most effectual diuretic in persons of a cold and sluggish habit of body.¹

5. *In amenorrhœa and chlorosis.*—In some cases of obstructed menstruation, benefit is obtained by the use of drastic purgatives, like colocynth, which act on the rectum, and, by contiguous sympathy, affect the uterus.

ADMINISTRATION.—The *powder*, which is rarely used, may be administered in doses of from two to eight or ten grains, intimately mixed with some mild powder (gum, or starch). The *decoction* (prepared by boiling ʒij of colocynth in Oj of water for six minutes, and, according to Hufeland, adding to the strained liquor ʒij. of the spirit of sulphuric ether, and fʒj of syrup of orange-peel) is given in doses of fʒss three times a day. The *tincture* (prepared according to the Prussian Pharmacopœia, by digesting ʒj of colocynth pulp and ʒj of star anise, in ℥bj of rectified spirit) is given in doses of twenty drops. Colocynth has been employed iatropæically by Dr. Chrestien.² The tincture of colocynth, or an ointment consisting of twenty grains of the powder mixed with hogslard, has been used by way of friction on the abdomen and inner side of the thighs, in disorders of the intellectual functions. Diuresis was a common effect.

ANTIDOTE.—See *Elaterium*.

¹ Eberle, *Mat. Med.* 2d edit. i. 119.

² *Méth. Iatral.* p. 172.

The following are the official preparations of colocynth:—

1. **EXTRACTUM COLOCYNTHIDIS**, L. E.; *Extract of Colocynth*.—(Colocynth, cut in pieces, rejecting the seeds, ℥iij; Distilled Water Cong. ss. Macerate the colocynth for thirty-six hours, frequently squeezing it with the hand. Press out the liquor, and finally evaporate to a proper consistence, L. Colocynth ℥ij; Water Cong. ij. Boil gently for six hours, replacing the evaporated water occasionally. Strain the liquor while hot, and evaporate it in the vapour-bath to due consistency, E.)—When the decoction is very concentrated, it readily gelatinizes on cooling; hence it is necessary to strain it while hot. At Apothecaries' Hall, the produce of 100 lbs. of pulp is about 65 lbs. of extract.¹ Extract of colocynth is an objectionable preparation, as it is very apt to become either mouldy or tough and hard by keeping. The dose of it is grs. v to ℥j.

2. **PILULA COLOCYNTHIDIS COMPOSITA**, L. D.; *Pilulæ Colocynthidis*, E. (formerly called *Compound Extract of Colocynth*); (*Extractum Colocynthidis Compositum*, U. S.)—(Extract of Colocynth ℥j; Powdered Extract of Aloes ℥vi; Powdered Scammony ℥ij; Powdered Cardamoms ℥ss; Soft Soap ℥jss. Mix the powders, and, the remaining ingredients being added, beat all together so that a mass may be formed, L. Pulp of Colocynth, in fine powder, ℥j; Hepatic Aloes, in fine powder, ℥ij; Scammony, in fine powder, ℥j; Oil of Cloves ℥j; Castile Soap ℥j; Treacle, by weight, ℥x. Reduce the soap to a fine powder, and mix it with the colocynth, aloes, and scammony, then rub all together with the oil of cloves and treacle, and beat them into a mass of a uniform consistence, D.²—The process of the *Edinburgh College* is as follows: "Socotrine or East Indian Aloes, and Scammony, of each eight parts; Colocynth, four parts; Sulphate of Potash and Oil of Cloves, of each one part; Rectified Spirit, a sufficiency. Pulverize the aloes, scammony, and sulphate of potash, together; mix with them the colocynth previously reduced to fine powder; add the oil of cloves; and, with the aid of a small quantity of rectified spirit, beat the whole into a proper pill mass, which is to be divided into five-grain pills."—Compound pill of colocynth, made according to the *London Pharmacopœia*, is an exceedingly valuable preparation; but owing to carelessness, inattention, fraud, or ignorance, the preparation of the shops is very unequal in its powers. The aloes used in the process should be purified (by straining) as directed by the *London College*; the necessity of this will be obvious to any one who has ever seen a cwt. of aloes melted. Should the Cape variety be substituted for the finer kind of aloes, the odour will detect the fraud. The scammony employed should be of the best quality. If the common (*i. e.* adulterated) kinds be used, the activity of the preparation is thereby deteriorated. If the compound pill, rolled into a ball and dropped into water, effervesce³ on the addition of hydrochloric acid, we may infer that the scammony employed was adulterated with chalk. If the filtered decoction, slightly acidified, become blue or purplish on the addition of tincture of iodine, the presence of some starchy substance (as jalap or adulterated scammony) may be inferred. The mode of detecting gamboge will be described hereafter (see *Gamboge*). If colocynth seeds have been employed as a substance for the pulp, the tenacity of the extract, I am told, is greatly deteriorated. Some druggists substitute oil of cardamoms for the powder of the seeds, and by this means increase the odour of the preparation; but unless some inert powder be added to compensate for the powder of the seeds omitted, the strength of the preparation would be somewhat greater than that intended in the *Pharmacopœia*.

[The compound extract of colocynth is thus directed by the *U. S. Pharm.*: Take of Colocynth, deprived of the seeds and sliced, six ounces; Aloes, in powder, twelve ounces; Scammony, in powder, four ounces; Cardamom, in powder, an ounce; Soap three ounces; Diluted Alcohol a gallon. Macerate the colocynth in the

¹ Barker and Montgomery, *Obs. on the Dub. Pharm.*

² In the Dublin preparations, avoirdupois weight is directed to be used.

³ If the extract has been kept for some time, it will effervesce, though it be made from pure scammony—probably from the alkali of the soap becoming carbonated.

diluted alcohol with a gentle heat for four days. Express and filter the liquor, and add to it the aloes, scammony, and soap; then evaporate to the proper consistence, and, near the end of the process, mix the cardamom with the other ingredients.]

The compound pill of colocynth is a powerful, sure, yet safe cathartic. Its uses are the same as those of extract of colocynth, before described. The dose of it is from five grains to a scruple. Calomel is frequently given in combination with it. The *Pilulæ cathartice compositeæ*, U. S. contain the compound pill of colocynth, extract of jalap, and calomel. Extract of hyoscyamus is frequently given in conjunction with the compound extract of colocynth. (See *Pilulæ Colocynthis et Hyoscyami*, E.)

In the shops, a cheap substitute for the compound pill of colocynth is often sold under the name of *pill. cochix* (*pilulæ coccix*, or *pilulæ cochix minores* of Galen). The substitute sold under this name at Apothecaries' Hall, London, is the *Pilulæ colocynthis*, Ph. Ed. without the sulphate of potash.

Colocynth is a constituent of *Morison's Pills*.¹

8. *PILULÆ COLOCYNTHIDIS ET HYOSCYAMI*, E.; *Pills of Colocynth and Henbane*.—(Colocynth pill mass *two parts*; Extract of Hyoscyamus *one part*. Beat them well together, adding a few drops of rectified spirit, if necessary; and divide the mass into thirty-six pills.)—Extract of hyoscyamus diminishes the pain and griping frequently experienced from the use of colocynth, but does not injure its evacuant properties. Both Sir H. Halford and Dr. Paris² bear testimony to this.—The dose of this pill is grs. v to grs. xv.

4. *ENEMA COLOCYNTHIDIS*, L.; *Colocynth Glyster*.—(Extract of Colocynth \bar{z} ss; Soft Soap \bar{z} j; Water Oj. Mix, and rub them together.)—A useful cathartic enema in obstinate constipation, whether arising from colic or from other non-inflammatory conditions.

252. ECBALIUM OFFICINARUM, L.; ECBALIUM AGRESTE, D. (*Momordica Elaterium*).—WILD OR SPIRTING CUCUMBER.

Sex. Syst. Monœcia, Syngenesia, Linn.³

(Fructus recens tantum non maturus, L.—Feculence of the juice of the fruit, E.—Fructus; Fœcula, Folia, D.) [*Elaterium*, U. S.]

HISTORY.—The term *λατῆριον* (from *ελαυνω*, *I impel* or *urge forward*) was employed by the Greeks to signify, not merely a medicine prepared from the *σίχνη ἀγρίου*, or *wild cucumber* (*Momordica Elatarium*), but also any purgative substance.⁴ Hippocrates⁵ employed the root and leaves of the plant, as well as *ελατῆριον*, in medicine. Dioscorides⁶ minutely describes the method of preparing *ελατῆριον* by drying the feculence of the expressed juice of the fruit, and making it into troches. Pliny⁷ calls the plant *Cucumis sylvestris*, and gives a short account of the method of making elaterium. C. Baubin⁸ terms the plant *Cucumis asininus*, or *asses' cucumber*.

[BOTANY. *Gen. Char.*—Tendrils lateral. *Stamens* monadelphous. *Anthers* connate. *Calyx* of males campanulate. *Fruit* expelling the seeds with elasticity; indehiscent. (Richard.)

Sp. Char.—Hispid, scabrous. *Stem* dwarf, without tendrils. *Leaves* cordate, somewhat lobed, crenate-toothed, very rugose, on long stalks. (Richard.)—Ed.]

Root annual. *Stem* thick, round, trailing, and branching. *Leaves* obtuse,

¹ See Fenzler's Report of the Trial of Joseph Webb, at York Assizes, 1834, p. 53.

² *Pharmacologia*, 6th edit. i. 299.

³ *Fœtus*, *Econom. Hipp.*

⁴ *Lib. iv. cap. 155.*

⁵ *Phœzæ*, 344.

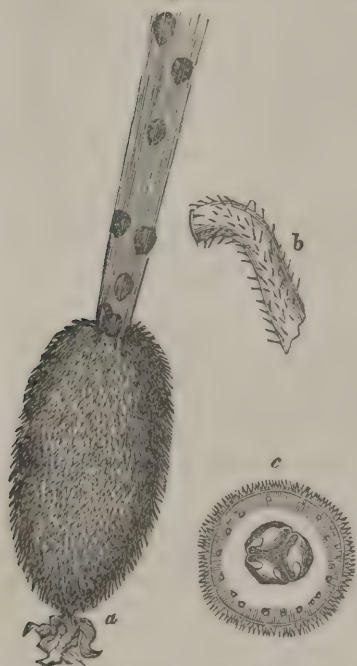
⁶ See the note to *Cucumis Colocynthis*, p. 1735.

⁷ *Opera*, ed. Fœs. pp. 418, 547, and 877.

⁸ *Hist. Nat. lib. xx. cap. 1 and 2, ed. Vulp.*

grayish, and strongly reticulated on the under side; petioles long and bristly.

Fig. 353.



Momordica Elaterium.

- a. Pepo expelling its seeds.
b. Stalk.
c. Transverse section of the pepo.

ration of endosmosis; consequently, the central cell gradually becomes very much distended (at the expense of the liquid in the tissue of the pericarp), and ultimately gives way at the weakest point; namely, where the peduncle is articulated with the fruit, and the contents of the cells are expelled with great violence, from the sudden contraction of the distended tissues.

Seat of Elaterium.—Some years since Dr. Clutterbuck² ascertained that the active substance, elaterium, “is neither lodged in the roots, leaves, flowers, nor stalks, in any considerable quantity; nor is it to be found in the body of the fruit itself, or in the seeds contained within it; it was only in the juice around the seeds, therefore, that it could be looked for,” and here it was found. The precise situation of it will be readily comprehended by inspecting a transverse section of the elaterium pepo (see Fig. 353, c). We observe that the external portion of the pericarp (namely, the epicarp) is furnished with rigid hairs; within the epicarp is a whitish sarcocarp, forming what Dr. Clutterbuck terms the body of the fruit. The centre of the fruit is divided into three cells, by projections of the three parietal placentaë to which the seeds are attached. Between these projections, and surrounding the seeds, is the *pulp*, the *placentary matter*, or the *juice around the seeds* (Clutterbuck). It is paler than the sarcocarp, and is composed of a very lax tissue, which, as the fruit matures, takes on, says Aug. St. Hilaire, a gelatinous consistency, becomes disorganized, and melts into water.

“The centre of the fruit of *Momordica Elaterium*,” says Dutrochet,³ “contains a very singular organic substance, and which has no resemblance to any other vegetable tissue. It seems to be a green very thick mucus. Viewed by the microscope, it appears to consist of an immense quantity of very small globules, agglomerated sometimes confusedly, sometimes so as to form irregular strise. This substance is penetrated by a whitish liquid, by a sort of emulsion, which is so much the more dense as we observe it at an epoch nearer maturity. This aqueous liquid

Flowers axillary: the males form racemes of 5 or 6 flowers. *Calyx* adherent, with 5 lanceolate acute teeth. *Corolla* campanulate, yellow, reticulated with green veins. *Males*: *Stamina* 3, two of which bear doubly-folded anthers [or 5, four of which cohere, so as to form two bundles of two anthers each]. *Females*: *filaments* 3, sterile; *ovarium* inferior, 1-celled (spuriously 3-celled); *style* simple; *stigmas* 3, bifid. *Pepo* small, elliptical, pedunculated, grayish-green, covered with soft prickles; when ripe separating from its stalk, and expelling with considerable violence its brown seeds, and a thin mucus through the aperture at the insertion of the stalk.

The phenomenon of the expulsion of the seeds of this plant has acquired, of late years, increased interest from the circumstance of Dutrochet¹ having adduced it as one of the effects of *endosmosis*. It is well known that when two fluids of unequal density are separated from each other by membrane (animal or vegetable), a double permeation of fluids takes place—that is, each fluid passes through the membrane, and mixes with the other fluid; the current in one direction is called *endosmosis*, that in the opposite direction *exosmosis*.

Now to apply these facts to the phenomena of the Elaterium apple. In the centre of this fruit, and surrounding the seeds, is a very singular variety of organic matter, which appears like thick mucus. It is called by some botanists *placentary matter* (see Fig. 353, c). External to this, that is, in the tissue of the pericarp, there is another organic liquid, whose density is less than that of the placentary matter. These two fluids being separated from each other by membrane, are in a proper condition for the operation of endosmosis.

¹ *Nouv. Rech. sur l'End.* p. 66, 1825.

² *Op. cit.* p. 69.

³ *Lond. Med. Rep.* vol. xii.

escapes immediately we open the green fruit. By the microscope, we see some almost imperceptible globules which swim in this liquid. At the epoch of maturity, this whitish liquid is much more abundant, and at the same time much denser; the globules, which it holds in suspension, have become much larger."

Hab.—South of Europe. Common on rubbish in the villages of Greece and the Archipelago. A few acres of it are annually cultivated at Mitcham.

EXTRACTION OF ELATERIUM—We are indebted to Dr. Clutterbuck for the present improved method of manufacturing elaterium.

a. DR. CLUTTERBUCK'S PROCESS.—"The cucumbers should be gathered when nearly as ripe as possible, and without violence that might endanger their bursting. They should then be wetted by the affusion of cold water, that less of the juice when they are cut may adhere to the external surface. In this state, they should be cut through longitudinally, and the juice allowed to strain through a fine sieve placed in a large earthenware vessel. The seeds and surrounding pulp should be scooped out upon the sieve, and washed with repeated affusions of cold water, by which they will be freed from all adhering juice. Something will be saved also by afterwards rinsing the split cucumbers themselves in cold water, from which a portion of elaterium may be collected.

"After standing a few hours, a sediment is formed, from which the clear liquor is to be poured off; it is then to be thinly spread on fine linen, and exposed to the air to dry; a gentle warmth may be employed without injury, but the access of sunshine destroys the fine green colour which the substance otherwise acquires." From forty fruits, Dr. Clutterbuck obtained only six grains of elaterium. The elaterium thus procured is of the finest quality; but the product is very small.

β. PROCESS OF THE BRITISH PHARMACOPŒIAS.—The *London College* gives the following directions for its preparation: Slice ripe wild cucumbers lengthwise, and strain the juice, very gently expressed, through a very fine hair-sieve; then set it by for some hours, until the thicker part has subsided. The thinner supernatant part being rejected, dry the thicker part with a gentle heat.—The processes of the *Edinburgh* and *Dublin Colleges* are essentially the same.

γ. PROCESS ACTUALLY FOLLOWED.—The following is the mode of preparation which I have seen practised at Apothecaries' Hall, London: The fruits are cut longitudinally in halves by women, and are then placed in a hempen cloth, and put into a common screw-press. Apparently, a tolerable pressure is applied, but for a few minutes only, being removed before all the juice has ceased running out. A greenish, slightly turbid liquor runs out. When the fruits are taken out of the press, they are but very slightly crushed, so that the pressure cannot have been great. The juice, as it runs from the press, falls into a hair-sieve, through which it flows into a cylindrical-lipped glass jar. Here it is allowed to remain for about two hours, during which time a greenish scum is deposited. The supernatant liquor is then carefully poured off, and the thicker liquor at the bottom is placed on a paper filter supported by a cloth filter stretched on a wooden frame. A bitter, yellowish-brown (sherry-coloured) liquor runs through, and a green mass is left on the filter. The latter is then carefully dried by a stove, and constitutes the *finest elaterium*. The mother liquor, which was poured off from the deposit, is placed in shallow brown pans, and there lets fall a fresh deposit, which, when separated and dried, forms a *paler elaterium*.

After the elaterium has been deposited from the juice, a mucilaginous matter subsides, which greatly deteriorates the elaterium (if it has not been previously separated), and renders it, when dry, dark, gummy, and much curled.

THEORY OF THE PROCESS.—Dr. Clutterbuck's experiments have shown that the finest elaterium is obtained without pressure from the fruits when nearly as ripe as possible. In practice, however, pressure must be employed; because the cucumbers must not be too ripe when gathered, or they are apt to burst during their journey to town, or by handling; and in this imperfectly ripe state the juice does not flow from them until pressure be employed. If the juice of one of the fruits be received on a plate of glass, it is at first nearly colourless and transparent. In a few minutes, however, by exposure to the air, it becomes slightly turbid (milky); and small white coagula are formed in it. By slow and spontaneous evaporation, crystals of a rhomboidal figure are perceptible on the glass when examined by a magnifier. These crystals are *Elaterin*. They are probably formed by the influence of the air on the juice. Elaterium of commerce consists essentially of this elaterin contaminated with the green colouring matter, cellular tissue, and starch, expressed from the fruit, and mixed with the residue obtained by drying the bitter liquor above referred to, with which the tissues and elaterin were moistened.

DESCRIPTION.—The Elaterium (*Elaterium*; *Extractum Elaterii*, L. E. D.) of

commerce is a very variable article. Two kinds are distinguished, the *English* and the *Maltese*.

1. **English Elaterium** (*Elaterium anglicum*) is manufactured at Apothecaries' Hall, at Mitcham, and perhaps at other places. The *finest* (*Elaterium album*, Aut.) occurs in light, friable, thin, very slightly curled flakes, or flat cakes, or fragments, which frequently bear the impression of the paper or muslin on which the elaterium was dried. Its colour is pale, grayish-green, which by exposure becomes yellowish. Its taste is acrid and bitterish; it has a faint animal odour (not very dissimilar to that of ergot of rye), but combined with a fragraney which reminds me of senna or tea. By keeping nine or ten years, a sample of good elaterium in my museum has assumed a sparkling appearance, as if it contained very minute crystals.

Inferior kinds (*Elaterium nigrum*, Auct.) are sometimes hard, break with difficulty, or with a resinous fracture, are much curled, gummy, and dark coloured (brown or olive-green). They are probably prepared from the juice, after the finest elaterium has been separated. In my museum, I have several varieties of this inferior kind, which were collected by Dr. Clutterbuck. One is in the form of a brownish powder. Dr. Clutterbuck states that of the best specimens of elaterium from Apothecaries' Hall, spirit dissolves more than half; while of inferior sorts, a fourth part only is dissolved. Mr. Barry¹ says that the solubility of elaterium, manufactured by Dr. Clutterbuck's process, is as follows:—

Ten grains of <i>Elaterium</i> , manufactured according to Dr. Clutterbuck's process.		Dissolved in spirit, of Specific gravity 0.859.
By Messrs. Allen and Co.	1st sample	5.5 grains.
	2d sample	6.2 "
	3d sample	6.4 "
At Apothecaries' Hall		6 "

2. **Maltese Elaterium** (*Elaterium melitense*).—This is imported from Malta. It is in much larger flakes than the best English elaterium, and frequently has some adherent paper on which it has been dried; its colour is much paler, sometimes with hardly a trace of green. Some specimens are more friable and softer, and occasionally are rather chalky to the touch. My specimens are mixtures of chalk and starch; hence they effervesce with acids, and become blue with iodine. I am assured that Maltese elaterium is mixed, in this country, with buckthorn juice, to deepen its colour, and promote its purgative operation.

COMPOSITION.—Braconnot² analyzed the expressed, boiled, filtered, and evaporated juice of the plant. Soon after Dr. Clutterbuck's experiments on elaterium, Dr. Paris³ analyzed this substance. In 1831, Mr. Hennell⁴ published an analysis of it. In 1835, Landerer⁵ examined the juice of the fruit growing in Nauplia (Napoli). Farthermore, the active principle of elaterium was examined in 1831 by Dr. Morries,⁶ and afterwards by Marquart.⁷

Dr. Paris's Analysis.		Mr. Hennell's Analysis.	
<i>Elatin</i>	1.2	Crystallizable substance (<i>Elaterin</i>) . . .	44
Bitter matter . . . }		Green Resin	17
Extractive	2.6	Starch	6
Fecula	2.8	Woody fibre	27
Gluten	0.5	Saline matters	7
Woody matter	2.5		
Water	0.4	Elaterium	101
Elaterium	10.0		

1. **ELATERIN** (*Eluterine*; *Momordicine*).—Dr. Clutterbuck showed, in 1819, that the active principle of elaterium was insoluble in water, but soluble in alcohol: for he found a watery infusion of eight grains had no effect, whereas the alcoholic extract in the dose of one-sixteenth of a grain produced considerable purging, and often vomiting; and when the dose was increased to a quarter of a grain the effect was more considerable, and often took place in a very few minutes. The action of these liquids on elaterium, led Dr. Clutterbuck to believe that the active

¹ Paris. *Pharmacol.*

² *Pharmacologia*.

³ *Pharm. Central-Blatt für 1835*, 154.

⁴ *Pharm. Central-Blatt für 1833*, S. 550.

⁵ *Journ. Phys.* lxxxiv. 292.

⁶ *Journal of the Royal Institution*, i. 532.

⁷ *Ed. Med. and Surg. Journ.* xxxv. 339.

principle was of a resinous nature. But the alcoholic tincture of elaterium contains three principles: elaterin, the green resin, and a bitter matter. By treating this alcoholic extract with boiling distilled water, the bitter matter is dissolved; the residue (elaterin and green resin) was termed by Dr. Paris *clutin*. Dr. Morries, in 1831, separated the green resin and isolated elaterin; though Mr. Hennell seems to have discovered it about the same time. Dr. Morries obtained it by evaporating the alcoholic tincture of elaterium to the consistence of thin oil, and then throwing it into boiling distilled water; a white crystalline precipitate was formed, which increased as the liquor cooled. This precipitate was afterwards purified by a second solution in alcohol and subsequent precipitation by water. Mr. Hennell's process was different. He separated the resin from the crystalline matter of the alcoholic extract of elaterium by ether, which took up the resin and left the elaterin; the latter was then purified by solution in hot alcohol and subsequent crystallization. Marquart's process is less likely to yield pure elaterium, since he procured it from an extract prepared by evaporating the expressed juice. Another method (founded, I presume, on the directions of the Edinburgh College) for the determination of the goodness of elaterium, is to treat the alcoholic extract of elaterium with a solution of potash, which takes up the bitter matter as well as the resin, and leaves the elaterin. The quantity of elaterin in elaterium is thus stated by different authorities:—

100 parts of <i>Elaterium</i> .	Quantity of <i>Elaterin</i> .
Prepared according to the London College (<i>Hennell</i>)	44
Best British <i>Elaterium</i> (<i>Morries</i>)	26
Worst ditto (<i>Morries</i>)	15
French <i>Elaterium</i> (<i>Morries</i>)	5 or 6
<i>Elaterium</i> (<i>Edinburgh Pharmacopæia</i>)	14.3 to 25
Best specimens (<i>Balmer</i> !)	33
Fine sample, prepared at Apothecaries' Hall in 1839, and dried by steam heat (<i>Pereira</i>)	26

These discrepancies must arise principally from the different degrees of goodness of samples examined; but partly also from different modes of proceeding. I found that 30 grs. of fine elaterium, prepared at Apothecaries' Hall in 1839, lost by drying on a steam-bath 1.5 grs. Boiled in repeated portions of rectified spirit, the dried mass lost 18 grs. The concentrated green tincture poured into dilute liquor potassæ (see process of the *Edinburgh Pharmacopæia*, p. 1506) deposited crystals which, dried by steam heat, weighed 7.5 grs.

Elaterin possesses the following qualities: it is crystalline, and has a silky appearance; the crystals, viewed by a magnifying glass, are observed to be rounded prisms with striated sides; it is very bitter, but odourless; is neither acid nor alkaline, and is insoluble in water, but soluble in hot alcohol. Mr. Hennell says it is only very slightly soluble in ether; whereas Dr. Morries states it to be readily soluble in both ether and fixed oil. It is fusible, according to Mr. Hennell, at 350° F., or at 392° Phillips. Mr. Hennell states that it is composed of Carbon 36.9, Hydrogen 23.9, and Oxygen 39.2, which nearly corresponds to the formula $C_6H_{12}O_5$.² Dr. Morries says that at a high temperature it is dissipated in a thick, white, pungent vapour, having an ammoniacal odour; if so, nitrogen must be a constituent. But neither by the odour, nor by turmeric, can I detect ammonia in this vapour. The late Dr. Duncan, of Edinburgh, ascertained that in doses of one-twelfth or one sixteenth of a grain it had all the effects of a dose of elaterium. "A tenth of a grain," says Dr. Christison, "as I have myself witnessed, will sometimes cause purging in man; and a fifth of a grain, in two doses, administered at an interval of twenty-four hours to a rabbit, killed it in seventeen hours after the second dose." Dr. Golding Bird thinks one-sixteenth of a grain a fair dose to commence with; he repeats it every two hours until some effect is produced. It may be taken dissolved in spirit, and by this diffused through an aqueous vehicle.

2. **GREEN RESIN** (*Chlorophylle*?).—Is insoluble in water, but dissolves in alcohol, ether, and caustic potash. It does not redden litmus, though from its ready solubility in caustic potash its acid nature might be suspected. Some of it, prepared by Mr. Hennell, was tried at St. Bartholomew's Hospital, and found to act powerfully as a purgative in doses of less than a third of a grain. Perhaps this might have arisen from the presence of elaterin; for twenty-one grains of the resin yielded four grains of elaterin.

3. **BITTER MATTER**.—This is soluble both in water and alcohol. Its taste is intensely bitter; its colour is brownish yellow.

CHARACTERISTICS.—Good elaterium is friable, has a pale greenish-gray colour, and an animal odour. Digested in rectified spirit, it yields a fine green tincture. Thrown into water it floats. It does not effervesce in diluted hydrochloric acid; the acid liquor being digested on elaterium, and subsequently rendered nearly neutral by ammonia, gives scarcely any cloudiness on the addition of oxalate of ammonia. Touched with tincture of iodine, it gives no evidence of the presence of starch; though, if it be boiled in water, the decoction, when cold, gives traces of starch, by

¹ *Lond. Med. Gaz.* xxv. 909.

² [According to Zweuger, its composition is $C_6H_{14}O_5$.—Ed.]

the blue colour developed on the addition of iodine. If the ash formed by the burning of elaterium in the air be ignited in the outer cone of the flame of a candle, the presence of potash is indicated by the bluish or violet tinge.

Maltese elaterium has no odour, and scarcely any green tinge. Examined by the microscope, it is found to contain globules of wheaten starch. It sinks in water, effervesces with diluted hydrochloric acid, yielding a solution which, when nearly neutralized by ammonia, gives a copious precipitate (*oxalate of lime*) on the addition of oxalate of ammonia. Tincture of iodine stains it bluish or greenish black (*iodide of starch*). If the cinder obtained by burning Maltese elaterium in the air be ignited in the outer cone of the flame of the candle, it communicates an orange tint to the flame (lime?). The adulteration of elaterium by starch was known to Dioscorides. The *Edinburgh College* (1841), gives the following characteristics of good elaterium:—

“Colour pale-gray; when exhausted by rectified spirit, the solution, concentrated, and poured into hot diluted aqua potassæ, deposits, on cooling, minute silky, colourless crystals, weighing from a seventh to a fourth of the elaterium.”

In the *Edinburgh Pharmacopœia* for 1839, it was stated that elaterium should yield “at least a seventh” of elaterin; and in the first edition of the *Elements*, I observe that “these characteristics are not sufficiently accurate. Good elaterium is pale *greenish*-gray; and when treated as the College directs, should yield 26 per cent. of crystals (*i. e.* elaterin).” It will be seen that the College has somewhat modified its original statement.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Macaire found a branch of the *Momordica Elaterium* was speedily destroyed by immersing it in a solution of the extract of this plant.¹

β. On Animals.—Viborg² gave a pound of the fruit of *Momordica Elaterium* to a horse without any effect. Two and a half pounds of the whole plant (roots, leaves, and stem) also appeared inert.

The only experiments made with the extract of elaterium that I am acquainted with, are those of Orfila³ on dogs. They are three in number, and prove that this substance is a powerful local irritant, producing death, even when it has been applied to the cellular tissue of the thigh, in consequence, as he supposes, of the nervous system being sympathetically affected. Moreover, he concludes, from his observations, that elaterium exerts a special action on the rectum.

γ. On Man.—The acridity of elaterium in its local operation is well shown by various facts. Pliny truly observes that the juice of the elaterium apple is dangerous when applied to the eye; and Dr. Clutterbuck mentions that some of it “getting accidentally into the eye in one instance, it occasioned severe pain and inflammation, with an erysipelatous swelling of the eyelids, that continued till the following day.” We have a farther proof of its irritant properties in the inflammation and ulceration of the fingers of those employed in its preparation. When swallowed, it irritates the gastro-intestinal membrane, and occasions vomiting and violent purging; hence it is called a *drastic purgative*. Fine elaterium, in the dose of $\frac{1}{8}$ th of a grain, seldom fails to purge violently, and sometimes to vomit. This was long since noticed by Dr. Clutterbuck; and I can verify his statement from repeated observations. Even $\frac{1}{10}$ th of a grain will generally excite considerable purging. The elaterium of the shops, however, is rarely so active as this; and I have known two grains given with no more effect than the pure elaterium would excite in the dose of $\frac{1}{8}$ th of a grain. Elaterium powerfully excites the secreting and exhaling vessels of the alimentary canal, and thereby occasions very watery stools; hence the term *hydragogue* applied to it. In some dropsical cases, I have known a single dose discharge several pints of fluid by the bowels. The gripings and the increased number of evacuations prove that the irritation is not confined to the mucous coat, but is extended to the muscular

¹ *Mém. de la Soc. de Phys. de Genève*, iv.

² *Tox. Gén.*

³ Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 206.

coat. Under the influence of a full dose, the pulse is excited, the tongue becomes dry, and sometimes furred, and great thirst is produced. Occasionally, the skin becomes damp under the operation of elaterium.

Elaterium has been supposed to exert a specific influence over the uterus. Thus Dioscorides and even later writers state that it provokes the menses, and is apt to produce the death of the fœtus in utero. Its uterine influence, however, is probably not greater, in proportion to its cathartic property, than that of other violent drastics, which act powerfully on the large intestines.

Does elaterium become absorbed? We have no stronger evidence to offer in favour of the affirmative of this question than that mentioned by Hippocrates,¹ that the milk of women and goats who have eaten elaterium, or the wild cucumber, possesses purgative properties. Farthermore, the accident which occurred to Dr. Robert Dickson, Lecturer on Botany at St. George's Hospital, seems to prove that absorption must have taken place by the skin.² Dr. Dickson carried a specimen of the plant in his hat to his lodgings, in Paris, from the Jardin-du-Roi. In half an hour he experienced violent headache, which was followed by colicky pain, violent purging, vomiting, and fever.

Considered with respect to other cathartics, we find it pre-eminently distinguished by the violence of its purgative effect. Croton oil alone approximates to it. Its hydragogue operation exceeds that of most, if not all other, ordinarily used drastics.

USES.—The principal use of elaterium is to excite watery evacuations in *dropsy*, by which a twofold effect is to be hoped for; viz. *first*, absorption of the effused fluid; *secondly*, the stoppage of any farther effusion in consequence of the metastasis of vital action from the seat of the dropsy to the intestinal membrane. In dropsies dependent on, or accompanied with, disease of the kidney, the evacuation of water from the bowels is much to be preferred to the employment of stimulating diuretics, which may add to the severity of the renal malady. Of the violent hydragogue purgatives, elaterium I believe to be the most useful in dropsy. It evacuates more watery fluid than the others; while, if it be good, its operation may be relied on. It is objectionable where there is great debility, and where any inflammatory or other disease of the bowels exists. I have seen the fatal termination of dropsy apparently accelerated by the use of elaterium. A dropsical patient, much debilitated, took, by order of his physician, a dose of elaterium, which caused excessive alvine evacuations, great exhaustion, sinking of the pulse, syncope, and death. Where no contra-indication to the use of elaterium exists, one or two doses of it should be given every other day, for a week or ten days. If continued longer than this, it might perhaps bring on an inflammatory condition of the bowels. Dr. Darwall³ mentions a case in which hypercatharsis and maniacal delirium were produced by the prolonged use of elaterium; the delirium, however, went off in a few hours. Some tonic (usually gentian) is commonly conjoined with elaterium. Thus, a pill composed of elaterium and extract of gentian is frequently employed; or, we may exhibit infusion of gentian on alternate days with the elaterium. Where there is a febrile condition of system, and also where there is an irritable or inflammatory condition of the alimentary canal, elaterium is inadmissible. It is best adapted for cold phlegmatic constitutions. Sydenham⁴ recommended elaterium in dropsy; afterwards, Lister,⁵ Heberden,⁶ Ferriar,⁷ Clutterbuck,⁸ and other experienced practitioners, bore testimony to its exceeding great efficacy. But judging by the doses recommended, all of them, except the last-mentioned writer, seem to have been unaware of the great activity of the medicine when pure.

2. In cerebral affections, such as apoplexy, or a tendency to it (manifested by sleepiness, stupor, or giddiness), mania, &c., elaterium, as a drastic purgative, sometimes proves serviceable on the principle of counter-irritation or revulsion.

¹ *Épidémior.* lib. vi. sect. 5.

² *Cyclop. Pract. Med.* art. *Anasarca*, vol. i. p. 79.

³ *D. hydropse.*

⁴ *Med. Hist. et Reflex.* vol. iv.

⁵ *Journ. de Chim. Méd.* iv. 61.

⁶ *Works*, by Dr. Peckey, 4th edit. p. 393, 1705.

⁷ *Comment. art. Dropsy.*

⁸ *Lectures in Lancet* for May 6, 1826, p. 170.

3. *In obstinate constipation* from sluggishness of the intestinal tube, elaterium is occasionally useful. But care must be taken to ascertain that the constipation does not depend on any mechanical impediment (as hernia, or intussusception) to the passage of the feces.

4. *In gout*.—A combination of elaterium and opium has been found serviceable in gout.¹

ADMINISTRATION.—The dose of good elaterium is from one-sixteenth to one-half of a grain. I hear and read of practitioners giving this substance to the extent of one, two, or even three grains; but this can only be from the bad quality of the drug. I have repeatedly employed, and seen others exhibit elaterium, and have always observed that a quarter of a grain of good elaterium acted very powerfully, sometimes bringing away several pints of fluid; and half a grain usually occasioning vomiting, as well as violent purging. I confess I should not venture to exhibit a grain of the same preparation. It is usually given in the form of pills. The basis of the pills may be extract of gentian.

As elaterin (the active principle of elaterium) is soluble in rectified spirit, a *tincture of elaterium* (*tinctura elaterii*) may be employed. It contains, besides elaterin, a bitter principle and green resin. *Elaterin* has been given either in powder (mixed with sixty-four times its weight of bitartrate of potash), or in solution in rectified spirit (*solutio elaterinæ*), by Dr. Golding Bird,² in doses of one-sixteenth to one-eighth of a grain.

ANTIDOTES.—In the event of a case of poisoning by elaterium, the remedies would be demulcent drinks and clysters, opium, the warm bath, and fomentations to the abdomen; stimulants (such as ammonia and brandy) if the circulation fail; bloodletting to subdue the inflammatory symptoms, should the state of the general system not contraindicate it.

OTHER DIETETICAL, MEDICINAL, OR POISONOUS CUCURBITACEÆ.

The fruits of several cucurbitaceous plants are employed as articles of food. The Cucumber (*Cucumis sativus*), the Melon (*Cucumis Melo*), the Water Melon (*Cucumis Citrullus*), the Vegetable Marrow (*Cucurbita ovifera*), the Pumpkin or Pumpion (*Cucurbita Pepo*), and the Melon-Pumpkin or Squash (*Cucurbita Melopepo*), are those in most frequent use. They contain a watery, sweet or acidulous cooling pulp, which is slightly nutritious when taken raw, and in some habits proves laxative.

The fresh root of *Eryonia dioica* is sold by herbalists under the name of *White Bryony* and *mandrake root*. Fashioned into a rude representation of the human figure, I have seen it exhibited at an herb-shop as a sign. Bryony root contains a peculiar bitter matter called *bryonia*. The root operates as a violent emetic and purgative. I have seen one case of poisoning by it. The symptoms were those of cholera. As the accident occurred at the time when this disease was raging here, the practitioner who was called in concluded it was a case of cholera, and mistook a piece of bryony root, shown him as being part of what the patient had eaten, for a piece of turnip. The patient (a woman) recovered. Bryony root is employed as a topical application to bruised parts.

ORDER LVIII. MYRTACEÆ, R. Brown.—THE MYRTLE TRIBE.

CHARACTERS.—*Sepals* 4—6, generally 5, concreted into a tube, which is adnate to the ovary, sometimes distinct at the apex, and as far as the margin of the ovary, at other times concrete at the apex, and as far as the throat. *Petals* inserted on the calyx, as many as the sepals with which they alternate, and quincuncial in æstivation, very rarely absent. *Stamens* inserted with the petals, often in many rows, double, or generally many times the number of the petals: *filaments* either free or variously all connected or polyadelphous, before flowering somewhat incurved; *anthers* ovate, bilocular, small, dehiscing by a double chink. *Carpella* 4—6, generally 5,

¹ Sutton, *Tracts on Gout*, p. 201.

² *Lond. Med. Gaz.* xxv. 905.

by abortion often fewer, concrete into a many-celled ovary, which is adnate to the calyx. *Style*, composed of many partial styles concreted, and, therefore, called single, with a simple stigma. *Fruit* various, many-celled, many seeded. *Seeds* various; *embryo* exalbuminous. (De Cand.)—*Trees* or *shrubs*. *Leaves* generally opposite, rarely alternate, exstipulate, quite entire, dotted with pellucid glands, and usually with a vein running parallel with their margin. *Inflorescence* variable; usually axillary. *Flowers* red, white, occasionally yellow, never blue.

PROPERTIES.—Aromatic volatile oil and astringent matter (especially the former) are the principles to which the medicinal properties of Myrtaceæ are referable. The pellucid dotting of the leaves and other parts indicates the volatile oil.

253. MELALEUCA MINOR, *Smith, L. E.*; MELALEUCA CAJUPUTI, *D.*—THE LESSER MELALEUCA.

Melaleuca Cajuputi, Maton, Roxburgh.

Sex. Syst. Polyadelphia, Icosandria.

(*Oleum* è foliis destillatum, *L.*—Volatile oil of the leaves, *E.*)

HISTORY.—This tree was described by Rumphius¹ under the names of *Arbor alba minor*, *Cajuputi*, *Daun kitsjil*, and *Caju-kilan*. It has got its name from its colour *kāyu-puti*, which signifies *white wood*, and hence its appellation, as given to it by Rumphius, *arbor alba*.²

BOTANY. **Gen. Char.**—Tube of the *calyx* almost hemispherical; limb 5-partite. *Petals* 5. Bundles of *stamens* 5, elongated, alternate with the petals; *anthers* incumbent. *Style* filiform; *stigma* obtuse. *Capsule* connate with, and inclosed in, the thickened tube of the calyx, which is adnate at its base to the branch; 3-celled, many-seeded. *Seeds* angular. (De Cand.)—*Trees* or *shrubs*. *Leaves* alternate or opposite, quite entire, equal at the base. *Flowers* sessile, or somewhat adnate, spiked or capitate, white, yellowish, or purplish.

Sp. Char.—*Leaves* alternate, elliptical-lanceolate, somewhat acute, slightly falcate, 3–5-nerved. *Flowers* spiked, rather distant. *Rachis*, *Calyx*, and *branchlets*, villose. (De Cand.)

Trunk tolerably erect, but crooked; *bark* thick, spongy, whitish ash-coloured, the exterior lamina peeling off in thin flakes. *Branches* scattered, often drooping. *Leaves* short-stalked, while young silky, when full grown smooth, deep green, from 3 to 5 inches long, and from half to three-quarters of an inch broad, very aromatic when bruised. *Spikes* terminal. *Bracts* solitary, lanceolate. *Calyx* urceolate. *Corolla* white. *Filaments* from 30 to 40, united into five portions at the base; *anthers* with a yellow gland at the apex. *Style* rather longer than the *stamina*; *stigma* obscurely 3-lobed; *ovary* ovate, united to the calyx. *Capsule* 3-valved.³

Hab.—Moluccas.

EXTRACTION OF THE OIL.—Rumphius⁴ states that the leaves are gathered on a warm day, and placed in a sack, where they become hot and damp. They are then macerated in water, and left to ferment for a night, and afterwards submitted to distillation. Two sackfuls of the leaves yield scarcely three drachms of oil, which is limpid, pellucid, and volatile. Lesson⁵ has described the method of obtaining the oil at Bourou, one of the Molucca Islands. The leaves, he says, are gathered in the latter end of September, and put into the cucurbit of a copper alembic, surmounted by a neck, terminated by a capital without a refrigeratory, and a sufficient quantity of water is then added. By distillation, this liquid is made to traverse a worm immersed in a hogshead filled with water, and is collected in a vessel; the oil which floats is very light, and of an herbaceous green colour, which is owing to chlorophylle, or perhaps a somewhat different resinous principle. By rectification it becomes colourless.

DESCRIPTION.—*Cajuput* or *Kijapootie* oil (*oleum cajuputi*) is usually imported

¹ *Herb. Amboin.* lib. ii. p. 76.

² *Mat. Indica*, i. 261; and Crawford, *Hist. Ind. Archip.* vol. i. p. 513.

³ Condensed from Roxburgh, *Fl. Ind.* iii. 395; and *Trans. Med.-Bot. Soc.* April 11, 1828.

⁴ *Herb. Amboin.*

⁵ *Journ. de Chim. Méd.* iii. 237.

in green glass bottles (in appearance similar to long-necked beer bottles). Its colour is green, the tint being that of a strong solution of chloride of copper. It is transparent, limpid, of a strong penetrating smell, resembling the combined odour of camphor, rosemary, and cardamom, and of an aromatic camphoraceous taste, succeeded by a sensation of coolness like that caused by oil of peppermint. In the mass the odour is disagreeable, but in small quantity, as when rubbed on the hand, is much more fragrant. An apparently pure sample, which has been several years in my museum, has a sp. gr. of 0.925. Dr. Thomson¹ says the sp. gr. varies from 0.914 to 0.9274; while Mr. Brande² states it to be 0.980. Oil of cajuput is soluble in alcohol. Its boiling point is 343°. When carefully distilled with water, the first portion of oil which passes over is very light, and quite colourless; but towards the end of the process a heavier and greenish oil distils over.

COMPOSITION.—According to Blanchet³ the composition of oil of cajuput (C₉H₉O) is as follows:—

	Atoms.	Eq. Wt.	Per Cent.
Carbon	10	60	77.92
Hydrogen	9	9	11.69
Oxygen	1	8	10.39
Cajuputi Oil	1	77	100.00

ADULTERATION.—M. Guibourt⁴ detected in several samples of oil of cajuputi, oxide of copper in solution. It is, he says, easily recognized by shaking the oil with a solution of ferrocyanide of potassium, when a red precipitate (*ferrocyanide of copper*) is formed. To this metal, derived as is supposed from the copper vessels in which the oil has sojourned, M. Guibourt ascribes the green colour of the oil. This conclusion, however, was somewhat premature; for all the samples of the oil which I have examined were, though green, quite devoid of copper; and Mr. Brande observes, that none of the samples which he has examined have contained even a trace of copper.

In 1831, oil of cajuputi was extolled as a remedy for cholera.⁵ In consequence of the great demand for it, which was thereby created, the price rose from 2 to 14 shillings per ounce; and various imitations of it soon made their appearance in the market. One of these consisted of oil of rosemary flavoured with camphor and oil of cardamoms, and coloured. Except on this extraordinary occasion, the oil of cajuputi met with in the shops of this country I believe to be pure as imported.

PHYSIOLOGICAL EFFECTS.—Cajuput oil is a powerful antispasmodic diffusible stimulant and sudorific. From the ordinary distilled oils (as those of the labiate plants and umbelliferous fruits) it is distinguished by its stronger influence over the nervous system (evinced by its antispasmodic qualities) and by the greater diffusibility of its stimulant operation. It is allied to valerian, between which and camphor it ought to be placed, in a physiological classification; but in large doses it does not disorder the mental faculties as these two medicines do.

USES.—Cajuput oil has acquired considerable celebrity among the Malays; and has been more frequently employed in Germany than in any other European nation. By British practitioners its uses have hitherto been very limited. As a *diffusible stimulant* it is useful where we wish promptly to raise the energy of the vital powers, especially when at the same time any spasmodic movements are to be allayed. With these views it has been employed in low fevers, paralytic affections, and cholera. In the last-mentioned diseases it acquired an ephemeral reputation, in consequence of the favourable reports of Sir Matthew Tierney, and others.⁶ As an *antispasmodic*, it is a very efficacious remedy, in painful spasmodic affections of the stomach, and in flatulent colic; but of its uses in epilepsy, chorea, hysteria,

¹ *Org. Chem.* 476.

² Quoted by Thomson, *op. cit.*

³ *Lond. Med. Gaz.* viii.

⁴ *Dict. of Pharm.*

⁵ *Journ. de Chim. Méd.* vii. 612.

⁶ *Lond. Med. Mag.* vol. vii. pp. 625, 633, 736, &c.

tetanus, spasmodic asthma, and some other spasmodic diseases, in which its efficacy has been extolled by oriental and continental practitioners, I have no experience. As a *stimulating sudorific*, it proves occasionally useful in chronic rheumatism, painful affections, and local paralysis. As an *anthelmintic*, it was used by Rudolphi.

ADMINISTRATION.—The dose of it is from 2 to 10, or even more, drops. It may be taken on sugar, or in the form of an emulsion.

254. CARYOPHYLLUS AROMATICUS, Linn. L. E. D.—THE CLOVE TREE.

Sex. Syst. Icosandria, Monogynia.

(Flos nondum explicatus; Oleum è flore nondum explicato destillatum, L.—Dried undeveloped flower; Volatile oil of the undeveloped flowers, E.—Flores nondum explicati, et Oleum volatile, D.)

HISTORY.—The *garyophyllon* of Pliny¹ cannot have been our clove, since this naturalist describes it as being like a peppercorn, but larger and more brittle. Indeed, it is not certain who first speaks of the clove. Paulus Ægineta² notices *καρυόφυλλον*, and, I think, probably refers to the clove; though Sprengel³ regards Simeon Seth as the first who mentions cloves.

BOTANY. *Gen. Char.*—Tube of the *calyx* cylindrical; limb 4-partite. *Petals* 4, adhering by their points in a sort of calyptra. *Stamens* distinct, arranged in four parcels, inserted in a quadrangular fleshy hollow near the teeth of the calyx. *Ovary* 2-celled, each cell containing 20 ovules. *Berry*, when ripe, 1- or 2-celled, 1- or 2-seeded. *Seeds* cylindrical or semi-ovate; *cotyledons* thick, fleshy, concave externally, sinuous in various ways internally; *radicle* arising from the centre of the cotyledons, straight, superiorly hidden by the cotyledons.—*Trees*. *Leaves* opposite, coriaceous, dotted. *Cymes* terminal or in the forking of the branches; somewhat corymbose. (De Cand.)

Sp. Char.—*Leaves* obovate-oblong, acuminate at both ends. *Cymes* many-flowered. (De Cand.)

Trunk from 15 to 30 feet high. *Leaves* about 4 inches long, with a strong midrib and parallel lateral nerves; footstalks slender, aromatic; almost 2 inches long. *Flowers*, odorous. *Calyx*, at first green, afterwards purplish-red. *Petals* 4, larger than the calyx, imbricated into a globe in bud, at length spreading, roundish, concave, yellowish-red, very soon caducous. In the centre of the calyx, and occupying the top of the ovary, is a quadrangular elevated line (or *gland*) surrounding, but not embracing, the base of the shortish, obtusely subulate *style*. *Filaments* much longer than the petals, yellow; *anthers* ovate-cordate, yellow, two-celled. *Ovary* oblong, or almost cylindrical. *Berry* purplish, elliptical, 1-seeded. *Seed* with a thin, soft integument; *embryo* elliptical, greenish, dotted. (Condensed from *Bot. Mag.* t. 2749.)

Hab.—Molucca Islands; where, as well as at Sumatra, Mauritius, Bourbon, Martinique, and St. Vincent's, it is now extensively cultivated. The short-sighted and selfish policy of the Dutch, to limit the cultivation of the plant to the Molucca Islands, has, therefore, completely failed.⁴



Caryophyllus aromaticus.

¹ *Hist. Nat. lib. xii. cap. 15, ed. Valp.*

² *Hist. rei herb. i. 247.*

³ See Marsden, *History of Sumatra*, 3d edit. p. 146; Smith, in Rees's *Cyclop. art. Caryophyllus*; Crawford, *East. Archip. iii. 388*; Hooker, *Bot. Mag. t. 2749.*

⁴ *De re medica, lib. vii. cap. 3.*

COLLECTION.—Cloves are collected by the hand, or beaten with reeds, so as to fall upon cloths placed under the tree, and dried by fire, or, what is better, in the sun.

COMMERCE.—They are imported in casks or bags. Those produced in the Molucca Islands usually come by way of Rotterdam. In 1839, duty (6*d.* per lb.) was paid on 93,549 lbs.

DESCRIPTION.—The clove of commerce (*caryophyllus*) is the unexpanded flower, the corolla forming a ball or sphere at the top, between the four teeth of the calyx, and thus, with the tapering, somewhat quadrangular tube of the calyx, giving the appearance of a nail (whence the word *clove*, from the French *clou*, a nail). The length of the clove is from five to ten lines; its thickness from 1 to 1 and a half lines. Its colour is dark brown with a yellowish-red tint; the corolla somewhat deeper. Good cloves should be dark brown, and perfect in all parts, have a strong fragrant odour, and a hot acrid taste, and when slightly pressed with the nail, give out oil. They are distinguished in commerce by their place of growth. Those from the East Indies (*Amboyne* and *Bencoolen* cloves) are the best; they are the largest, plumpest, and most oily. The *Bencoolen* clove is the most esteemed. Cloves produced in the French possessions (*Bourbon* and *Cayenne* cloves), are smaller, more shrivelled, contain less oil, and are of inferior value. The *Cayenne* clove is the least esteemed.

Under the name of **MOTHER CLOVES** (*matrices caryophylli* seu *anthophylli*) are described, in several authors, the fruits of the clove (*fructus caryophylli aromatici*) which have occasionally been introduced as articles of commerce, and a sample of which has been preserved in the collection of the East India House. On the 8th of February, 1841, five bags of mother cloves were put up for sale in London. They have the shape of an olive, than which they are smaller. Superiorly, they are crowned with the four teeth of the calyx, with the remains of the style in the centre. Their colour is similar to that of the clove; their odour and flavour similar, but much weaker. Internally, we find the embryo with its two sinuous cotyledons.



Mother
Clove.

The broken peduncles of the clove (*clove stalks*; *griffe de girofle*) are sometimes substituted by distillers for cloves (Guibourt).

COMPOSITION.—Cloves were analyzed by Trommsdorff,¹ who found them to consist of *volatile oil* 18, *almost tasteless resin* 6, *peculiar kind of tannin* 13, *difficultly soluble extractive with tannin* 4, *gum* 13, *woody fibre* 28, and *water* 18.

1. **VOLATILE OIL** (see p. 755).

2. **EUGENIN** (*Stéaroptène of Oil of Cloves*).—This was found in oil of cloves by Bonastre. It is in thin, white, pearly scales, which become yellow by keeping. It is very soluble in alcohol and ether; has the odour and taste of cloves, but weaker, and is reddened by nitric acid. According to Dumas, its composition is *Carbon* 72.25, *Hydrogen* 7.64, *Oxygen* 20.11; or $C^{20}H^{12}O^4$.

3. **CARYOPHYLLIN** (*Clove sub-resin*).—First described by Lodibert,² and afterwards examined by Bonastre.³ It is extracted from cloves by alcohol. The Molucca cloves yield the largest quantity of it; those of Bourbon contain less; and the Cayenne cloves none. It is a satiny, crystalline, odourless, tasteless, fusible, and volatile substance; insoluble in water, soluble in alcohol and ether; slightly so in caustic alkalies. It is reddened by sulphuric acid. According to Dumas⁴ it is composed of *Carbon* 79.5, *Hydrogen* 10.5, *Oxygen* 10.0; hence its formula is $C^{20}H^{10}O^2$; so that its composition is similar to that of camphor. [Dr. Sheridan Muspratt has lately examined the constitution of caryophyllin, and has arrived at the same result as Dumas. Dr. M. also believes cloves to contain a peculiar acid, which he has not yet sufficiently investigated.—En]

4. **CLOVE-TANNIN.**—The tannin of cloves is less acerb than ordinary tannin, and its compound with gelatine has less elasticity.

CHEMICAL CHARACTERISTICS.—Nitric acid reddens infusion of cloves. Tincture of sesquichloride of iron renders it blue. The oil of cloves also undergoes similar changes to the infusion. These facts deserve especial attention in relation to opium and morphia (see OPIUM), on account of the analogous phenomena presented by morphia when acted on by nitric acid and sesquichloride of iron.⁵ Infusion and oil of allspice are similarly affected.

¹ Gmelin, *Handb. d. Chem.* ii. 1272.

² *Ibid.* p. 103.

³ *Journ. de Pharm.* xi. 539 and 566.

⁴ *Journ. de Pharm.* xi. 101.

⁵ *Ann. de Chim. et Phys.* liii. 161.

PHYSIOLOGICAL EFFECTS.—Cloves have a very agreeable flavour and odour, and are devoid of the fiery taste and acidity which distinguish pepper and ginger; in other respects, their effects agree with those of other spices. Though volatile oil is by far the most important of their active principles, yet the tannin, extractive, and resin, must contribute something to their operation.

USES.—Cloves are principally used for culinary purposes, as flavouring ingredients. They are not employed in sufficient quantity to prove of much importance as condimentary stimulants, yet they are applicable as gastric excitants, in dyspeptic cases connected with relaxation of the alimentary canal. In medicine, cloves are rarely employed alone, or as the basis or principal medicine, but usually as an addition to other medicines, the flavour of which they improve, or whose operation they correct. When, however, they are given alone, it is merely as a stomachic and carminative, to relieve nausea, vomiting, flatulence, or some allied stomach disorder. Distillers prepare a liqueur called *cloves*.

ADMINISTRATION.—In substance, cloves may be taken in doses of 5 or 10 grains, or *ad libitum*.

1. **INFUSUM CARYOPHYLLI**, L. E. D. [U. S.]; *Infusion of Cloves; Clove Tea*.—(Cloves, bruised, ʒij [ʒij, D., U. S.]; Boiling [distilled, L.] Water Oj [ʒix, D.]. Macerate for 2 hours [1 hour, D.] in a vessel covered lightly, and strain [through calico, E.].—Aromatic, stimulant, and stomachic. Employed in dyspepsia, flatulent colic, and gout; generally in combination with other medicines. Ammonia increases its efficacy.—Dose, fʒj to fʒij.

2. **OLEUM CARYOPHYLLI**, L. E. [U. S.]; *Oil of Cloves*.—(Obtained by submitting cloves, with water, to repeated distillation.)—No directions are given by the London College for the preparation of oil of cloves, which is placed among the articles of the *Materia Medica*. The Dublin College gives general directions for its preparation from the dried undeveloped flowers.

To extract the whole of the oil from cloves, they must be subjected to repeated cohobations. On an average, they yield from 17 to 22 per cent. of volatile oil (including the heavy and light oils). By distillation with water, cloves yield two volatile oils—one lighter, the other heavier, than water. Mr. Whipple informs me that, by the ordinary modes of distillation, the heavy oil comes over first. The oil of cloves of commerce is a mixture of these two oils. When carefully and recently prepared it is colourless or light yellow, but by keeping becomes brownish-red. It has a hot, acrid taste, and the well-known odour of cloves, and is soluble in alcohol, ether, concentrated acetic acid, and the fixed oils. Its sp. gr. is probably variable, though always greater than that of water. Lewis found it to be 1.034. Bonastre¹ says that of the unrectified oil is 1.055, but by rectification part of the light oil is lost, and the sp. gr. is then 1.361. Ettling² says its composition is, *Carbon* 74.6279, *Hydrogen* 8.1531, and *Oxygen* 17.2189. To separate it into the two oils, he mixed it with potash-lye, and distilled; a *light oil* passed over, while a compound of the *heavy oil* (*clove acid*) and potash remained in the retort, and, by distillation with phosphoric or sulphuric acid, gives out the heavy oil.

a. *Light Oil of Cloves* (*Clove Hydro-Carbon*).—Colourless. Sp. gr. 0.918. Incapable of combining with bases, but absorbing hydrochloric acid gas without yielding a crystalline compound. It consists of $C^{30}H^8$; hence it is isomeric with oil of turpentine.

β. *Heavy Oil of Cloves* (*Clove Acid; Caryophyllic Acid; Eugenic Acid*).—It is colourless when recently prepared, but becomes coloured by age. Its sp. gr., according to Bonastre, is 1.079. It combines with alkalies to form crystalline salts (*alkaline caryophyllates or eugenates; clove-oil alkalies*). If a salt of iron be added to one of these, it yields a blue, violet, or reddish compound (*a ferruginous caryo-*

¹ *Ann. de Chim. et Phys.* xxxv.

² *Poggendorff's Annal.* xxxi. 526.

phyllate), varying somewhat according to the nature of the ferruginous salt used; thus, the protosulphate of iron yields a lilac, the persulphate a red, which becomes violet and afterwards blue; while the sesquichloride gives a vinous tint, which turns to red (Bonastre). Nitric acid reddens caryophyllie acid.

The composition of caryophyllie acid is as follows:—

	Atoms.	Eq. Wt.	Per Cent.	Ettling.	Boeckmann.
Carbon	24	144	72.36	72.6327	72.696
Hydrogen	15	15	7.54	7.4374	7.434
Oxygen	5	40	20.10	19.9297	19.870
Clove Acid	1	199	100.00	99.9998	100.000

This statement does not agree with that of Dumas, who from his first analysis¹ gave the formula $C^{20}H^{18}O^5$; and from his second one,² $C^{20}H^{12}O^5$. But various reasons, not necessary here to enumerate, lead me to believe that Ettling's formula is the correct one, supported as it is by Boeckmann's analysis, and by Dumas's statement, that the sp. gr. of the vapour of caryophyllie acid is 6.4.³

The oil of cloves is sometimes placed in the hollow of a carious tooth, to relieve toothache; but its more frequent medicinal use is as an addition to purgatives (e. g. *Pilulæ colocynthis*, E.) to check nausea and griping.—The dose of it is from 2 to 6 drops. Distillers and soap-makers extensively use oil of cloves.

3. **TINCTURA CARYOPHYLLI**; *Tincture of Cloves*.—(Cloves 3j; Rectified Spirit ʒiv. Macerate for seven days, and then filter.)—Though not contained in any of the British Pharmacopœias, this is a very useful and elegant preparation, and has a place in the French Codex. A solution of the oil in spirit is less agreeable, and becomes milky on the addition of water.—Dose, ʒj to fʒj. It may be usefully employed as an addition to purgative, stomachic, and tonic mixtures.

255. EUGENIA PIMENTA, De Candolle, E.—THE COMMON ALLSPICE.

(*Myrtus Pimenta*, Linn. L. D.)

Sex. Syst. Icosandria, Monogynia.

(Fructus immaturus, L.—Unripe berries, E. D.)

HISTORY.—It is scarcely probable that the ancients should have been acquainted with *allspice*, which is a native of the West Indies, and therefore could not have been known to Europeans before the discovery of America. Yet Clusius⁴ thought that it was the *garyophyllon* of Pliny;⁵ an opinion, however, which, for the above-mentioned reason, can scarcely be correct.⁶

BOTANY. **Gen. Char.**—Tube of the *calyx* roundish; limb divided as far as the ovary, into four segments. *Petals* as many as the lobes. *Stamens* indefinite, free. *Ovary* 2- or 3-celled; cells containing many ovules. *Berry* nearly globose, crowned by the calyx; when ripe 1-, rarely 2-celled. *Seeds* one or two, somewhat rounded, large; *embryo* spuriously monocotyledonous; *cotyledons* very thick, combined into one mass; *radicle* scarcely distinct, very short. (De Cand.)—*Trees* or shrubs.

Sp. Char.—*Peduncles* axillary and terminal, trichotomous-paniculate. *Flowers* 4-cleft, in the forks of the peduncle, nearly sessile, others paniculate. *Leaves* oblong or oval, pellucid-dotted, somewhat opaque, smooth. *Branches* terete; branchlets compressed; the younger ones, as well as the pedicels, pubescent. (De Cand.)

Trunk about 30 feet high. *Leaves* about four inches long, on short footstalks. *Flowers* numerous. *Sepals* roundish. *Petals* reflected, greenish-white. *Berry*

¹ *Ann. de Chim. et Phys.* liii. 164.

² *Pharm. Central-Blatt*, Oct. 13, 1838; from *Ann. de Pharm.* xxvii. 151.

³ *Ibid.*: also Thomson's *Org. Chem.* p. 1016.

⁴ *Hist. Nat. lib. xii. cap. 15, ed. Valp.*

⁵ *Exotic. lib. i. cap. 17.*

⁶ *Shoemaker's Jamaica*, ii. 77.

succulent, black or dark-purple when ripe; 2-seeded. *Embryo* roundish, with the cotyledons consolidated.¹

Hab.—West Indies. It is cultivated in Jamaica in regular walks (*Pimento walks*).

COLLECTION.—When the fruit has attained the full size, but is yet green, it is gathered and sun-dried on platforms and sheets. When nearly dry, it is frequently winnowed. It is afterwards put in bags of 1 cwt. each, for the European market.² Some planters kiln-dry it.

DESCRIPTION.—*Pimento* or *Jamaica pepper* (*pimenta* seu *piper jamaicense*), commonly called *allspice* (because its flavour is considered to approach that of cinnamon, cloves, and nutmegs), is about the size of, or somewhat larger than, a peppercorn. It is round, brown, dull, roughish but not wrinkled, crowned with the segments of the calyx, and occasionally, though rarely, has a short pedicel. It consists of an external, somewhat hard but brittle shell, which is paler within, and incloses two dark brown cochleate seeds. Allspice has an aromatic agreeable odour (intermediate between pepper and cloves), and a strong aromatic clove-like taste.

OVATE PIMENTO (*Brasilianischer oder Kron-Piment*, Dierbach;³ *Piment couronné* ou *Poire de Thet*, Guibourt.⁴)—This is the fruit of *Myrtus pimentoides*, Nees v. Esenbeck,⁵ called by De Candolle⁶ *Myrcia pimentoides*, a native of the West Indies. Except in shape, it strongly resembles the common allspice. It is ovate or oval, terminated superiorly by a large crown, formed by the 5-toothed limb of the calyx. It is usually 2-, more rarely 3- or 4-celled, each cell containing one seed. Guibourt has always found three, four, or six seeds in each fruit. In the only sample I have seen, and which came from St. Vincent's, there were in most of the fruits only two seeds.

COMMERCE.—Pimento is imported in bags, usually from the West Indies (almost entirely from Jamaica). In 1839, duty (9*d.* per lb.) was paid on 277,185 lbs.

COMPOSITION.—Pimento was analyzed by Braconnot,⁷ and in 1825 by Bonastre.⁸

<i>Bonastre's Analysis.</i>			<i>Braconnot's Analysis.</i>		
	Husks.	Kernels.			
Volatile oil	10.0	5.0	Volatile oil	1.9	
Green oil	8.4	2.5	Amylum	9.0	
Solid fat oil	0.9	1.2	Wax, with red colouring mat- ter	0.9	
Astringent extract	11.4	39.8	Gum	6.0	
Gummy extract	3.0	7.2	Nitrogenous matter	5.0	
Colouring matter	4.0	..	Citrate of Potash	6.0	
Resinous matter	1.2	..	Phosphate of Potash and loss	3.4	
Uncrystallizable sugar	3.0	8.0	Insoluble matter	67.8	
Malic or gallic acid	0.6	1.6			
Lignin	50.0	..			
Saline ashes	2.8	1.9			
Water	3.5	3.0			
Loss	1.6	1.8			
Red matter, insoluble in water . . . . .	..	8.8			
Pellicular residue . . . . .	..	16.0			
Brown flocculi . . . . .	..	3.2			
Total	100.0	100.0	Total	100.0	

1. VOLATILE OIL (see p. 758).

2. **GREEN OIL (Resin?).**—This substance, which has an acid burning taste, contributes to the activity of pimento. Its odour is rancid, but somewhat clove-like. It dissolves readily in alcohol and ether, to which it communicates a green colour.

3. **PIMENTO TANNIN.**—Is soluble in alcohol, strikes a green colour with the persalts of iron, and precipitates emetic tartar.

CHEMICAL CHARACTERISTICS.—See *Chemical Characteristics* of cloves.

PHYSIOLOGICAL EFFECTS.—Allspice possesses the general properties of the species already noticed. It holds an intermediate rank between pepper and cloves.

USES.—Its principal employment is by the cook, for flavouring. It may be taken with advantage by those troubled with relaxed or atonic conditions of stomach. In medicine, its uses are similar to those of cloves; viz. to relieve flatulency, to

¹ Condensed from *Botanical Magazine*, t. 1236.

² Wright, *Med. Plants of Jamaica*; Brown, *Nat. Hist. of Jamaica*, 248.

³ *Berlin. Jahrbuch*, Bd. xxxviii. S. 296.

⁴ *Icones Plant. Med.*

⁵ Duncan, *Edinb. Dispens.*

⁶ *Hist. des Drog.* ii. 351.

⁷ *Prodr.* iii. 243.

⁸ *Journ. de Chim. Méd.* i. 210.

cover the flavour of nauseous remedies, and to promote the operation of tonics and stomachics, and to prevent the griping of purgatives.

ADMINISTRATION.—In substance, allspice may be taken in doses of from ten grains to a drachm or more.

1. *OLEUM PIMENTÆ*, L. E. D. [U. S.]; *Oil of Pimento*; *Oil of Allspice*.—(Obtained by submitting allspice, bruised, with water, to distillation.)—Mr. Whipple informs me that from 8 cwt. of pimento he procured 41 lbs. 6 oz. of oil (heavy and light). This is nearly six per cent. He also informs me that the light oil comes over first, the reverse being the case with oil of cloves. The oil of pimento of the shops is a mixture of these two oils. Except in odour, its properties are almost identical with those of oil of cloves. By distillation with caustic potash, the *light oil* is separated; the residue, mixed with sulphuric acid and submitted to distillation, gives out the *heavy oil*.

a. *Light Oil of Pimento (Pimento-Hydro-Carbon)*.—Has not, to my knowledge, been previously examined. Its properties appear to be similar to those of the light oil of cloves. It floats on water and on liquor potassæ, and is slightly reddened by nitric acid. Potassium sinks in, and is scarcely if at all acted on by it.

β. *Heavy Oil of Pimento (Pimentic Acid)*.—Very similar to caryophyllic acid. It forms with the alkalies, crystalline compounds (*alkaline pimentates*), which become blue or greenish on the addition of the tincture of chloride of iron (owing to the formation of a *ferruginous pimentate*). Nitric acid acts violently on and reddens it.

The medicinal uses of the oil of pimento are very limited. It is sometimes employed to relieve toothache, to correct the operation of other medicines, as purgatives and tonics, and to prepare the *spiritus* and *aqua pimentæ*. The dose of it is from two to six drops.

2. *SPIRITUS PIMENTÆ*, L. E.; *Spirit of Pimento*; *Spirit of Allspice*.—(Oil of Pimento ʒij; Proof Spirit Cong. j, L.)—The *Dublin College* has not now a *Spiritus Pimentæ*, but the *Essentia Pimentæ* is an analogous preparation, made by mixing fʒix of the oil with fʒix of rectified spirit. The *Edinburgh College* directs half a pound of bruised pimento to be used, and to proceed as for spirit of caraway. Carminative and stomachic. Used in dyspepsia and flatulent colic. Dose, fʒj to fʒiv. In the shops, a spirituous solution of the oil is frequently substituted for the pharmacopœial preparation.

3. *AQUA PIMENTÆ*, L. E. D.; *Pimento Water*; *Allspice Water*.—(Pimento, bruised, ℥bj [Rectified Spirit fʒiij, E.]; Water Cong. ij, L. Mix, and let a gallon distil. The *Dublin College* directs one fluidounce of Essence of Pimenta to be mixed with a half a gallon of Distilled Water, and the mixture filtered through paper.)—Employed for its flavouring, carminative, and stomachic properties, as a vehicle for stimulant, tonic, and purgative medicines. Dose, fʒj to fʒij. In the shops it is usually prepared with the oil, according to the formula of the *Dublin College*.

OTHER MEDICINAL MYRTACEÆ.

The substance called *Botany Bay Kino* is the astringent inspissated juice of *EUCALYPTUS RESINIFERA*, or *Iron Bark*, a native of Australia and Van Diemen's Land. This tree, we are told,¹ sometimes yields on incision sixty gallons of juice. Botany Bay kino is imported in boxes. That which I have met with came from Van Diemen's Island. It occurs in irregular odourless masses, many of which are in the form of tears, somewhat resembling those of cherry-tree gum in form, and as large as the tears of Senegal gum. The purer pieces are vitreous, almost black in the mass, but transparent, and of a beautiful ruby-red in small and thin fragments.

¹ White, *Journal of a Voyage to New South Wales*, p. 231, 1790.

Some of the pieces, however, are opaque and dull, from the intermixture of wood and other impurities. When chewed, it sticks to the teeth, and has an astringent taste. Digested in cold water, it swells, becomes soft and gelatinous (like red-currant jelly), and yields a red liquid which reddens litmus, and yields precipitates with lime-water, gelatine, acetate of lead, sesquichloride of iron, and, if caustic potash or ammonia be previously added, with the chloride of calcium. Alcohol and emetic tartar occasion no precipitate. Digested in rectified spirit, Botany Bay kino becomes gelatinous, as with water, and yields a similar red solution, from which water precipitates nothing, but which reddens litmus, and deposits a copious precipitate when potash, ammonia, or lime-water, is dropped in. From these and other experiments, I infer that Botany Bay kino consists principally of a peculiar substance (*Eucalyptin*) analogous somewhat to *pectin* and *tannic acid*. It has been used in diarrhœa.¹ Ainslie² says it is the only kind employed in India; but I suspect there is some error in this statement.

ORDER LXII. LYTHRACEÆ, *Lindley*.—THE LOOSESTRIFE TRIBE.

SALICARIÆ, Jussieu—*LYTHRARIÆ, De Candolle*.

CHARACTERS.—*Sepals* definite in number, coherent beyond the middle. *Calyx* free, tubular or campanulate; lobes valvate, or distant in æstivation; the sinuses being sometimes lengthened into conical lobes or external teeth. *Petals* inserted on the upper part of the tube of the calyx, between the lobes, various in number, sometimes none, generally very caducous. *Stamens* inserted into the tube of the calyx below the petals; equal, double, triple, or quadruple the number of petals, sometimes fewer. *Anthers* oval, bilocular, adnate. *Ovary* free; *style* filiform; *stigma* capitate. *Capsule* membranous, covered or surrounded by the calyx of 2 to 4 carpels; while young, generally (always?) 2-celled, by the slender margins of the carpels being inflexed; but when ripe, 1-celled, by the disappearance of the dissepimenta, either dehiscing longitudinally, or more rarely and irregularly with a circumscissile dehiscence. *Placenta* central, adnate to the dissepiment when present, or free, thick, either compressed-cylindrical or obscurely trigonal or tetragonal; the apex with some threads, conveyers of the seminal aura, continuous with the base of the style. *Seeds* many, small, exalbuminous; *embryo* straight; *radicle* turned towards the hilum; *cotyledons* flat, foliaceous. (De Cand)

PROPERTIES.—Variable. Except *Lythrum Salicaria*, which is astringent, the medical properties of few species are well known. *Nesæa salicifolia* is said to be diuretic, diaphoretic, and purgative.

256. LYTHRUM SALICARIA, *Linn.*—SPIKED PURPLE LOOSESTRIFE.

Sex. Syst. Dodecandria, Monogynia.

HISTORY.—As this plant is a native of the Grecian Archipelago, it must have been known to the ancients; but hitherto it has not been satisfactorily identified with any plant described by them.

BOTANY. **Gen. Char.**—*Calyx* cylindrical, striated, toothed at the apex; teeth 8 to 12, of which four to six are broader than the rest, and erect, and the remaining four to six alternate ones, subulate, often horn-shaped, sometimes not present, or very small. *Petals* 4 to 6, arising from the apex of the tube, alternate with the erect teeth. *Stamens* arising from the middle or base of the calyx, double or equal the number of the petals, or by abortion fewer. *Style* filiform; *stigma* capitate. *Capsule* oblong, covered by the calyx, 2-celled, many-seeded. *Placentæ* thick, adhering to the dissepiment. *Herbs*, or rarely *undershrubs*. *Leaves* entire. *Flowers* axillary, purple or white. (De Cand.)

Sp. Char.—*Leaves* lanceolate, cordate at the base. *Flowers* spiked, almost sessile. (De Cand.)

Stems 2 or 3 feet high, 4-sided. *Spikes* very long. *Flowers* purple. *Petals* oblong, cuneiform. *Stamens* usually 12, of which six are long and six short.

Hab.—Ditches and watery places of this and other countries of Europe, west of Asia, New Holland, and North America.

¹ White, *op. cit.*

² *Mat. Indica*.

DESCRIPTION.—The herb (*Herba Salicariæ* seu *Lysimachia purpurea*), when dry, is inodorous, but has an herbaceous, somewhat astringent taste, and by chewing becomes very mucilaginous. Its infusion is darkened by the ferruginous salts.

COMPOSITION.—I am unacquainted with any analysis of this plant. Its obvious constituents are *tannic acid*, *mucilage*, *chlorophylle*, and *woody fibre*.

PHYSIOLOGICAL EFFECTS.—Demulcent and astringent.

USES.—Principally employed in diarrhœa and dysentery. In the former of these complaints it was recommended by Bang,¹ De Haen,² and others. In dysentery, it was spoken favourably of by Gardane,³ and others.

ADMINISTRATION.—Dose of the powdered herb ʒj twice or thrice a day. A decoction of the root, prepared by boiling ʒj of the root in Oj of boiling water, may be taken in doses of fʒj or fʒij.

[This herb formerly found a place in the *Materia Medica* of the Dublin College. It is omitted in the last edition of the *Pharmacopœia*.—ED.]

ORDER LXIII. GRANATEÆ, Don.—THE POMEGRANATE TRIBE.

CHARACTERS.—Tube of the *calyx* turbinate; limb 5- or 7-cleft, coriaceous; lobes valvate by æstivation. *Petals* 5 or 7. *Stamens* indefinite; *filaments* free; *anthers* anteriorly 2-celled, dehiscent by a double chink. *Style* filiform; *stigma* capitate, pimpled. *Fruit* large, spherical, crowned with the somewhat tubular limb of the calyx, coated with the tube of the calyx, indehiscent, unequally divided into 2 chambers by a horizontal diaphragm; the upper one 5- or 9-celled, the lower one smaller, 3-celled; the dissepiments of both membranous. *Placenta* of the upper chamber fleshy, spreading from the sides to the centre; those of the lower chamber irregular processes from its base. *Seeds* innumerable, mixed with a pellucid somewhat crystalline pulp, exalbuminous; *embryo* oblong; *radicle* short, straight; *cotyledons* foliaceous, spirally convoluted.—*Trees or shrubs*. *Leaves* deciduous, opposite, oblong, entire, without dots. *Flowers* scarlet. (De Cand.)

PROPERTIES—See *Punica Granatum*.

257. PUNICA GRANATUM, Linn. L. E. D.—THE COMMON POMEGRANATE.

Sex. Syst. Icosandria, Monogynia.

(*Fructûs cortex et radicis cortex*, L. (U. S.).—Root-bark, E.—Bark of the root, D.)

HISTORY.—The pomegranate is repeatedly referred to in the Bible.⁴ Homer⁵ also mentions it. The leaves, the flowers, and the fruit, were employed in medicine by the ancients.⁶

Fig. 356.



Punica Granatum.

BOTANY. Gen. Char.—Only one genus. (See the characters of the ORDER.)

Sp. Char.—*Leaves* lanceolate. *Stem* arborescent. (De Cand.)

Small tree, with a brownish bark. *Leaves* on short stalks, smooth. *Flowers* terminal on the young branches. *Calyx* thick, fleshy, red. *Petals* much crumpled, membranous, rich scarlet. *Stamina* numerous, inserted on the calyx; *anthers* yellow. *Ovary* roundish; *style* simple; *stigma* globular. *Fruit* larger than an orange, with a thick coriaceous rind, and crowned by the teeth of the calyx; cells several, arranged in two strata, one upper, the other lower, separated by a transverse diaphragm; lower stratum

¹ Act Reg. Soc. Med. Havn. vol. i. p. 100.

² Rat. Med. iii. 196; and iv. 250; quoted by Murray, App. Med.

³ Gazette de Santé, 1773, p. 65; quoted by Murray.

⁴ Numbers, xiii. 23; Deut. viii. 8, &c.

⁵ Odyss. vii. 120.

⁶ Dierbach, Arzn. d. Hippokr. 90; Dioscorides, lib. i. cap. 151-4; Pliny, Hist. Nat. xxiii. 57.

of 3, upper one of from 5 to 9 cells. Some difficulty having been experienced in comprehending the structure of this anomalous fruit, Dr. Lindley¹ has explained it thus: within the calyx are two rows of carpella, a lower and inner one, consisting of three or four carpella surrounding the axis, and placed in the bottom of the calyx; and an upper and outer one, consisting of from five to ten carpella, surrounding the lower, but adherent to the upper part of the tube of the calyx. The two strata or tiers of cells in the pomegranate are formed by the two rows or tiers of carpella; the upper and outer row being forced to the top of the fruit by the contraction of the tube of the calyx from which they arise. The transverse diaphragm is formed by the adhesion of the upper to the lower stratum of carpella; and the outer part of the rind of the pomegranate is formed by the calyx which contains the carpella.

Hab.—Northern Africa, from whence it has been introduced into Europe, where it is now naturalized. Asia (Bengal, China, Persia).

DESCRIPTION.—The flowers, called *balaustine flowers* (*flores granati seu balaustiae*), are odourless, of a fine red colour, and slightly styptic taste. They communicate a reddish colour to the saliva. The rind of the fruit (*cortex granati: malicorium*), when dry, occurs in irregular arched, dry, brittle, odourless, very astringent, and slightly bitter fragments, which are brownish (more or less yellow or reddish), and paler within. The seeds (*semina granati*) are each surrounded by a thin vesicle filled with an acidulous styptic juice. The root (*radix granati*) is woody, knotty, hard, heavy, of a yellow colour and astringent taste. Its bark (*cortex radiceis granati*) occurs in small fragments, of a yellowish or ash-gray colour externally, yellow within, brittle, not fibrous; of an astringent, but not bitter taste. By its want of bitterness it may be distinguished from the bark of the box-tree (*Buxus sempervirens*), which is said to be sometimes substituted for it. Moistened with water, and rubbed on paper, it leaves a yellow stain, which becomes deep blue by the contact of sulphate of iron.²

COMPOSITION.—Reuss³ examined the watery extract of the rind of the fruit. The bark of the root has been analyzed by Wackenroder;⁴ in 1824, by Mitouart;⁵ and, in 1831, by Latour de Trie.⁶

WATERY EXTRACT OF POMEGRANATE RIND.

Reuss's Analysis.	
Resin	0.92
Tannin	27.78
Oxidized tannin	10.19
Extractive	21.76
Gum	34.26
Loss	9.50

Extract of the Rind . . 100.00

BARK OF THE POMEGRANATE ROOT.

Wackenroder's Analysis.		Latour de Trie's Analysis.	
Rancid fat oil	2.46	Fatty matter.	
Tannin	21.92	Tannin.	
Starch with some mucilage of lime	26.09	Galic acid	
Woody fibre with albumen	45.45	Granadin (Mannite).	
Loss	4.08	Resin (copious).	
		Wax.	
		Chlorophylle.	
		[Insoluble matters].	

Dried Bark 100.00

Bark of the Root.

1. **MANNITE** (*Granadin*).—The sweet substance which Latour de Trie considered to be peculiar, and called *granadin*, has been satisfactorily shown⁷ to be mannite (see MANNA).

2. **TANNIC ACID.**—On this the astringency of the fruit and root almost solely depends. It is this principle which enables the infusion, or decoction, of the rind and bark to produce precipitates (*tannates*) with a solution of gelatine, and with the ferruginous salts.

3. **RESIN.**—Latour de Trie describes this as being without any remarkable odour and taste.

¹ Nat. Syst. 2d edit. p. 44; and *Introd. to Bot*

² Gmelin, *Handb. d. Chem.* ii. 1272.

³ *Journ. de Pharm.* x. 352.

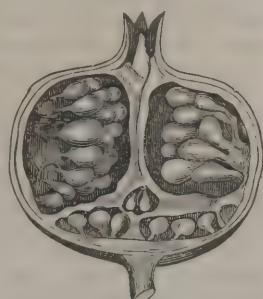
⁴ *Ibid.* xxi. 169.

⁵ Guibourt, *Hist. des Drog.* i. 501.

⁶ *Ibid.*

⁷ *Ibid.* xvii. 503—601.

Fig. 357.



Section of the Fruit of the *Punica Granatum*, showing the two strata of cells.

It is soluble in water, slightly so in cold alcohol, and more so in hot alcohol, and in small quantity in ether.

PHYSIOLOGICAL EFFECTS.—All parts of the plant (root-bark, rind of the fruit, juice surrounding the seeds, and flowers) possess astringency, owing principally to tannic acid, and in some slight degree to a minute quantity of gallic acid. The bark of the root, taken in small quantities, occasions no remarkable effects. In full doses, however, it causes nausea, vomiting, and purging, and occasionally giddiness and faintness.

USES.—Rarely employed in medicine. The root-bark has been occasionally used as a vermifuge. Celsus, Dioscorides, Pliny, and other ancient writers, speak of its anthelmintic qualities. The Indians, also, were acquainted with them at a very early period. Of late years, attention has been again drawn to this bark as a remedy for tape-worm, by the recommendations of Dr. Fleming,¹ Dr. Buchanan,² Mr. Breton,³ Gomes,⁴ Deslandes, and others;⁵ but in this country it has almost been entirely superseded by oil of turpentine and kousso. The rind of the fruit has been employed on account of its astringency, in the form of decoction, as a gargle, in relaxed sore throat; as an injection, in leucorrhœa; and, internally, in diarrhœa, dysentery, and colliquative sweats. The powder of the rind may be administered as a tonic. The flowers are mild astringents, but are not employed in this country. The fruit may be eaten to allay thirst, and as a refreshing refrigerant and astringent in febrile disorders, especially those called bilious. It contains an acidulous stypic juice, which is inclosed in a thin vesicle surrounding the seeds.

1. **DECOCTUM GRANATI RADICIS, L;** *Decoction of Pomegranate Root.*—This is prepared by boiling ʒij of the fresh bruised bark in Oij of water to Oj; the dose is a wineglassful every half hour till the whole is taken. It usually occasions slight sickness, but seldom fails to destroy the tape-worm. The patient should be prepared for the remedy by the use of a dose of castor-oil and a strict regimen the day previously.

2. **DECOCTUM GRANATI, L;** *Decoction of the Fruit-bark of the Pomegranate.*—(Of the Bark of the Fruit ʒij; Distilled Water Ojss. Boil to Oj and strain.)

ORDER LXIV. ROSACEÆ, Jussieu.—THE ROSE TRIBE.

CHARACTERS.—*Calyx* generally of 5 sepals, cohering at the base to form a tube; therefore 5-lobed, generally persistent, usually free, sometimes adherent to the ovary. *Petals* as many as the sepals, rarely by abortion none, inserted on the calyx, quincuncial in æstivation, generally regular. *Stamens* inserted with the petals, almost indefinite; *filaments* incurved in æstivation; *anthers* two celled, dehiscing by double chink. *Carpels* numerous, either solitary by abortion, or having the appearance of a single ovary, from their union, either together or with the tube of the calyx. *Ovaries* 1-celled; *styles* simple, dilated at the apex into *stigmas* of variable shape, usually arising from the side of the ovary, either distinct, or, more rarely, coherent. *Seeds* in each carpel usually one or two, seldom numerous; erect or inverse, exalbuminous (*Hirtella* and *Neillia* excepted). *Embryo* straight; *cotyledons* either foliaceous or fleshy. *Herbs, shrubs, and trees.* *Leaves* alternate, bistipulate at the base, simple or compound. *Inflorescence* various. (De Cand.)

PROPERTIES.—The prevailing quality of Rosaceæ is astringency. This is especially obvious in the root. The tribe Amygdalæ is distinguished from other rosaceous plants by the poisonous properties of the kernels and leaves, which yield hydrocyanic acid when distilled with water, and by the gummy exudation from the stems.

¹ *Asiatic Researches*, vol. xi.

² *Med.-Chir. Trans.* vol. xi. p. 301.

³ Bayle, *Bibl. de Thérap.* i. 313.

⁴ *Ed. Med. and Surg. Journ.* vol. iii. 22.

⁵ *Journ. Complém. des Sciences Méd.* xvi. 24.

TRIBE I. AMYGDALÆ.

258. *AMYGDALUS COMMUNIS*, Linn. *L. E. D.*—THE COMMON ALMOND.*Sex. Syst.* Icosandria, Monogynia.(Semen; *Amygdala dulcis*; Oleum ab alterutrisque nucleis expressum, *L.*—*Var. α*, Kernel: Bitter almond. *Var. β* and *γ*, Kernel: Sweet almond, *E.*—*Amygdalæ dulces*, *D.*)[*Amygdala Amara. Amygdala dulcis, U. S.*]

HISTORY.—Almonds were well known to the ancients; they are mentioned in the earliest part of the Old Testament.¹ Hippocrates employed both the sweet and bitter almonds, and their expressed oil, in medicine.² Dioscorides³ describes the mode of expressing the oil.

BOTANY. **Gen. Char.**—*Drupe* pubescent, velvety; with a fibrous, juiceless cortex, which falls off irregularly; *putamen* (shell) pitted or smooth. *Young leaves* folded flat (conduplicate). *Flowers* somewhat sessile, solitary or in pairs, earlier than the leaves, arising from scaly buds. *Fruit* woolly. (*De Cand.*)

Sp. Char.—*Leaves* oblong-lanceolate, serrulate. *Flowers* solitary. *Calyx* campanulate. *Fruit* ovoid-compressed, tomentose. (*De Cand.*)

A small tree. *Leaves* on glandular footstalks, acuminate. *Flowers* moderately large, rose-red or white, nearly sessile, appearing before the leaves. *Calyx* reddish, campanulate, 5-cleft; the segments blunt. *Petals* 5, ovate, irregularly notched, rose-red. *Stamens* numerous (about 30), shorter than the petals, inserted into the mouth of the calyx. *Ovarium* woolly; *style* simple; *stigma* round. *Drupe* ovoid, compressed, leathery, marked with a longitudinal furrow, where it opens when ripe; *epicarp* greenish-gray, tomentose; *mesocarp* (or *sarcocarp*) fibrous, cracking and dropping off; *endocarp* (*putamen*) woody or almost osseous, oblong or ovate, acute, marked with pits or furrows. *Seed* 1 (rarely 2) in each drupe.

*De Candolle*⁴ admits five varieties of this species:—

α. amara. Bitter Almond.—*Styles* almost as long as the stamens, tomentose below. *Seeds* bitter.—*Flowers* larger; *petals* white, roseate at the base. It varies with a hard and brittle *putamen*.

β. dulcis. Sweet Almond.—*Leaves* ash-green. *Flowers* earlier. *Styles* much longer than the stamens. *Fruit* ovate compressed, acuminate. *Seeds* sweet. *Putamen* hard.

γ. fragilis. Tender-shelled. *Flowers* coetaneous. *Petals* broader, quite emarginate. *Leaves* shorter; *petioles* thick. *Fruit* acuminate, sweet. *Putamen* soft.—*Flowers* somewhat roseate.

δ. macrocarpa. Large fruited.—*Leaves* broader, acuminate, scarcely ash-coloured. *Peduncles* shorter, turgid. *Fruit* larger, umbilicated, acuminate at the apex. *Putamen* hard. *Flowers* white-roseate, large, appearing before the leaves. *Petals* broadly obcordate, undulate. It varies —1st, with a lesser fruit called the *Sultana Almond*; 2dly, with a very small fruit termed the *Pistachio Almond*.

ε. persicoides. Peach Almond.—*Leaves* like those of the peach. *Fruit* oval, obtuse. *Sarcocarp* succulent. *Putamen* yellowish-black. *Seeds* sweet.—On the same branch the fruit is sometimes ovate, obtuse, and somewhat fleshy; and dry, ovate-compressed, and acuminate.

Hab.—Barbary and Syria. Cultivated in the southern parts of Europe.

DESCRIPTION.—*Almonds in the shell* (*Amygdalæ cum putamine*) consist of the seed, or kernel (*amygdala*), inclosed in the endocarp (*putamen* or *shell*), which may be hard or soft. The seed is of an oval shape, compressed, rounded at one end, and somewhat pointed at the other. The outer covering of the seed (*epidermis seminalis*, *Bischoff*) is glanduliferous, bitter, of a reddish-brown colour, and veined by the ramifications of the raphé. At the pointed

Fig. 358.



Section of an Almond.

a. One of the cotyledons.
b. Radicle and plumule.

¹ *Genesis*, xliii. 11.² *Lib.* i. cap. 39.³ *Opera*, ed. Fæs. pp. 481, 669, and 413.⁴ *Prodr.* ii. 530.

extremity of the seed is a small perforation (*foramen*), and on one side of this, at the edge, is the rugged line (*hilum*), which constitutes, botanically, the *base* of the seed. The seed is connected, at the hilum, with the shell by the *umbilical cord*. The larger or round end of the almond is curiously enough termed its apex. That part of the internal seed-coat (*endopleura*, De Candolle) which corresponds to the blunt or rounded end of the almond, is dark-coloured, indicating the situation of the *chalaza*. By soaking almonds in warm water, the seed-coats (pellicle or skin) are easily removed. *Blanched almonds* (*amygdalæ decorticatæ*) consist of the *embryo* only, composed of the two large fleshy *cotyledons*, between which, at the pointed extremity of the seed, we observe the *plumule*, with the *radicle* pointing towards the foramen (see Fig. 358).

1. **Sweet Almonds** (*Amygdalæ dulces*).—These are odourless, and have a bland, sweetish, agreeable taste. Three varieties are known in commerce: “1. *Jordan almonds*, which are the finest, come from Malaga.¹ Of these there are two kinds; the one above an inch in length, flat, and with a clear brown cuticle, sweet, mucilaginous, and rather tough; the other more plump and pointed at one end, brittle, but equally sweet with the former.—2. *Valencia almonds* are about three-eighths of an inch broad, not quite an inch long, round at one end and obtusely pointed at the other; flat, of a dingy-brown colour, and dusty cuticle.—3. *Barbary and Italian almonds* resemble the latter, but are generally smaller, and less flattened. Rancid, worm-eaten, and broken almonds, should be rejected.”² Sweet almonds are rarely employed for pressing, on account of their greater cost, and the less value of their residual *almond cake* (*placenta amygdalæ dulcis*). *Almond powder* (*farina amygdalæ*) is the ground almond cake, and is employed as a soap for washing the hands, and as a lute.

2. **Bitter Almonds** (*Amygdalæ amaræ*).—These are brought chiefly from Mogadore. In external appearance they resemble the sweet almond, but are somewhat smaller. They are distinguished by their bitter flavour, and, when rubbed with a little water, remarkable odour. They are extensively used for pressing. Their *cake* (*placenta amygdalæ amaræ*) is distilled with water to yield the *volatile oil of bitter almonds*, and is afterwards employed to fatten pigs, and for other purposes.

COMMERCE.—The following table shows the quantity of almonds (bitter and sweet (on which duty was paid during 1838 and 1839:—³

	Duty per cwt.	Quantity on which duty was paid.	
		In 1839.	In 1838.
Jordan	40s.	1596	1698
Not Jordan	20s.	3576	2200
Bitter	4s.	2145	1570

Almonds are imported in barrels, serons, boxes, and bales.

COMPOSITION.—*Sweet almonds* were analyzed by Proust;⁴ in 1817 by Boullay,⁵ and in 1825 by Payen and Henry fils.⁶—*Bitter almonds* were analyzed by Vogel.⁷

Boullay's Analysis.		Vogel's Analysis.	
Fixed oil	51.0	Volatile oil and hydrocyanic acid { quantity undetermined.	
Emulsin	24.0		
Liquid sugar	6.0	Fixed oil	25.0
Gum	3.0	Emulsin	30.0
Seed-coats	5.0	Liquid sugar	6.5
Woody fibre	4.0	Gum	3.0
Water	3.5	Seed-coats	8.5
Acetic acid and loss	0.5	Woody fibre	5.0
		Loss	19.0
Sweet Almonds	100.0	Bitter Almonds	100.0

1. **FIXED OIL OF ALMONDS** (See *post*, p. 768).

2. **EMULSIN** (*Vegetable Albumen of Almonds*).—This remarkable constituent of almonds is

¹ See Busby's *Journal of a Recent Visit to the Principal Vineyards of Spain and France*, p. 47, London, 1834.

² Brande, *Dict. of Pharm.* 55.

³ Gmelin, *Handb. d. Chem.*

⁴ *Journ de Chim. Méd.* i. 436.

⁵ *Trade List.*

⁶ *Ibid* vi. 406.

⁷ Gmelin, *Handb. d. Chem.* ii. 1265.

white, and soluble in cold water; hence it is a constituent of almond emulsion. From its watery solution it is precipitated in thick white flocks by alcohol; these flocks dissolve in water, even if they have been previously dried. If the watery solution be heated to 212° F. the emulsin coagulates, and the liquor becomes thick, like starch mucilage. From ordinary vegetable albumen, emulsin is distinguished by its producing the decomposition of amygdalin, and yielding, among other products, the volatile oil of bitter almonds and hydrocyanic acid. When, however, emulsin has been coagulated by heat, it loses its power of acting on amygdalin.¹ The composition of emulsin, according to Mr. Richardson,² is as follows:—

	Atoms.	Eg. Wt.	Per Cent.	Richardson.
Carbon	24	144	48.51	48.835
Hydrogen	23	23	7.79	7.732
Nitrogen	4	56	18.99	18.911
Oxygen	9	72	24.41	24.722
Emulsin	1	295	100.00	100.200

Boiled with baryta, emulsin evolves ammonia, and yields a barytic salt containing a peculiar acid, which has been termed *emulsic acid*. It is probable, therefore, that emulsin is an *amide of emulsic acid* (i. e. emulsate of ammonia, minus an atom of water). Robiquet³ regards the emulsin of Wöhler and Liebig as a very complex product.

3. **AMYGDALIN.**—A crystallizable substance found in the bitter, but not in the sweet almond. From four lbs. of bitter almonds Liebig obtained one ounce of pure amygdalin.⁴ It is white, odourless, has at first a sweet, then a bitter taste, is very soluble in boiling alcohol and water, but is insoluble in ether. Crystallized out of an alcoholic solution it is in pearly scales, and is anhydrous. The crystals obtained from a watery solution are colourless, transparent, and prismatic, and contain six atoms of water of crystallization. The watery solution has a feebly bitter taste. Submitted to distillation with nitric acid, it yields hydrocyanic acid, oil of bitter almonds, formic acid, and some benzoic acid. Heated with an alkaline solution, it evolves ammonia, and yields an alkaline salt, which contains a peculiar acid called *amygdalic acid*, composed of $C^{10}H^{26}O^{24} + Aq.$; hence, perhaps, amygdalin is an *amide of amygdalic acid* (i. e. an amygdalate of ammonia, minus an atom of water). By the action of a solution of emulsin on a solution of amygdalin, we obtain, among other products, hydrocyanic acid and a volatile oil of bitter almonds (see *Volatile Oil of Bitter Almonds*). The following is the composition of amygdalin, according to Wöhler and Liebig:—⁵

	Atoms.	Eg. Wt.	Per Cent.
Carbon	40	240	52.516
Hydrogen	27	27	5.908
Nitrogen	1	14	3.064
Oxygen	22	176	38.512
Amygdalin	1	457	100.000

In the crystallized state, it consists of 1 atom of *Amygdalin* = 457, and 6 atoms of *Water* = 54.

4. **VOLATILE OIL OF BITTER ALMONDS** (see *post*, p. 768).

PHYSIOLOGICAL EFFECTS AND USES. a. Of Sweet Almonds.—Sweet almonds are nutritive and emollient; but on account of the quantity of oil which they contain, they are somewhat difficult of digestion, at least if taken in large quantities, or by persons whose digestive powers are weak. When rancid, they are still more apt to disorder the stomach. The husk or pellicle of the almond has been known to occasion nausea, uneasiness in the stomach and bowels, increased heat, œdematous swelling of the face, followed by urticaria. Dr. Winterbottom⁶ suffered twice in this way from the use of unblanched sweet almonds, but blanched almonds caused no inconvenience.

For *dietetical* purposes, almonds are employed as a dessert, for puddings, cakes, &c. On account of the irritant qualities of the husk, almonds for the table should always be blanched. Blanched and roasted they have been used as a substitute for coffee.⁷ *Medicinally* they are used in the preparation of the *confection, emulsion, and oil*.

β. **Of Bitter Almonds.**—Bitter almonds are more or less poisonous to all classes of animals. As in the cases of other poisonous vegetable substances, the larger

¹ Wöhler and Liebig, *Journ. de Pharm.* xxxiii. 391.

² *Journ. de Pharm.* xxiv. 196.

³ *Op. cit.*; also *Journ. de Pharm.* xxiii.

⁴ Murray, *App. Med.* iii. 25.

⁵ Thomson, *Organ. Chemistry*, 683.

⁶ *Handwört. d. Chem.* p. 330.

⁷ *Med. Facts and Observ.* vol. v. p. 60.

herbivora are much less powerfully affected by them. Thus, three-quarters of a pound of bitter almonds, given to a horse, caused merely dulness and a small pulse.¹ One drachm of bitter almonds has killed some of the smaller animals, as pigeons.² Twenty seeds have killed a small robust dog.³ The symptoms which they induce in animals, are, trembling, weakness, palsy, convulsions (often of the tetanic kind), and, finally, coma. If vomiting occur early, the animal in that way may escape.

In small doses bitter almonds sometimes act on man as irritants to the digestive organs, and occasion nausea, vomiting, and purging. Owing to idiosyncrasy, some individuals are remarkably affected by them. On the late Dr. Gregory they caused, "first, sickness, generally tremors, then vomiting, next a hot fit, with an eruption of urticaria, particularly on the upper part of the body. At the same time the face and head swelled very much, and there was a general feeling like intoxication. The symptoms lasted only a few hours. The rash did not alternately appear and disappear, as in common nettle-rash," (Christison.) *In large doses*, bitter almonds have caused serious, or even fatal consequences. Pierer⁴ mentions that three children having eaten some of these seeds, were attacked in a few minutes with nausea, vomiting, loss of consciousness and of speech, and convulsions. Mr. Kennedy⁵ has noticed the case of a stout labourer, who died after the use of a great quantity of bitter almonds. These, and other observations referred to by Wibmer,⁶ Coullon,⁷ and others, prove that the poisonous effects of the bitter almond are similar to those of hydrocyanic acid.

The *emulsion of bitter almonds* partakes of the properties of the seeds. Pouzaire (quoted by Wibmer) states that a child of between four and five years of age suffered colic, head affection, grinding of the teeth, trismus, insensibility, and death, from the use of a strong dose of this liquid.

The *distilled water of bitter almonds* (*aqua amygdalæ amaræ*) possesses poisonous properties, when either swallowed or applied externally.⁸ Sömmering states that half an ounce of concentrated bitter almond-water killed a dog.⁹

Macaroons and *Ratafia* cakes, as well as *Noyau*, which owe their peculiar flavour to bitter almonds, act injuriously when taken in large quantities.¹⁰ The principal consumption of the bitter almond is for pressing, flavouring, and scenting. For flavouring, the seeds or their essential oil are used by the cook and confectioner.

By medical practitioners in this country, bitter almonds are rarely prescribed. They sometimes enter into the composition of the almond emulsion (see *Mistura Amygdalæ*, Ph. E. D.), but usually as a flavouring ingredient only. They are applicable, however, to all the uses of hydrocyanic acid; as pulmonary affections, gastrodynia, and hooping-cough; but the objection to their use is their varying and uncertain strength. Bergius,¹¹ and subsequently Frank, Hufeland,¹² and others, have successfully administered them against intermittent fever. They have also been used to expel tape-worm, and, it is said, with good effect.¹³ Pitschaft¹⁴ prescribed bitter almond water to relieve painful menstruation. The emulsion has been employed as a wash to relieve irritation in various skin diseases; as herpes, prurigo, acne, impetigo, &c.

ADMINISTRATION.—Bitter almonds may be taken in substance or emulsion. Kranichfeld¹⁵ employed the powder of the bitter almond cake (*farina amygdalæ amaræ*) in doses of 1 to 6 grs. As a substitute for the *distilled water of bitter almonds* (*aqua amygdalæ amaræ*), which is of variable strength, Wöhler and Liebig¹⁶ recommend the following emulsion (*emulsio amygdalæ cum amygdalinâ*) on account

¹ Viborg; quoted by Wibmer, *Wirk d. Arzneim. u. Gifte*, i. 157.

² Wepfer, *Hist. Cicut. aquat.* p. 298, Lugd. 1733.

³ Quoted by Wibmer, *op. supra cit.*; also *Lond. Med. Review*, vol. ii. p. 286, Lond. 1800.

⁴ *Lond. Med. and Phys. Journ.* lvii. 150.

⁵ *Recherches, &c. sur l'Acide Hydrocyan.* 1819.

⁶ See Döltz's Experiments, in Wibmer, *op. supra cit.*

⁷ See Virey, *Journ. de Pharm.* ii. 204, for the ill effects of the first of these.

⁸ *Mat. Med.* i. 433.

⁹ Hufeland's *Journ.* Bd. xi. St. 4, S. 179.

¹⁰ Dierbach, *Neuest. Entd. in d. Mat. Med.* Bd. i. 397, 1837.

¹¹ *Journ. de Pharm.* xxiii. 415.

¹² Orfila, *Toxicol. Gén.*

¹³ *Op. supra cit.*

¹⁴ *Op. supra cit.*

¹⁵ Buchner, *Toxikolog.*

¹⁶ Richter, *Ausf. Arzneim.* ii. 511-2

¹⁷ Dierbach, *op. supra cit.*

of its uniform strength: Sweet Almonds ʒij ; Water and Sugar sufficient to make ʒij of emulsion, in which, when strained, dissolve Amygdalin grs. xvij. This quantity of amygdalin, when acted upon by the emulsion, yields one grain of anhydrous hydrocyanic acid, and 8 grains of volatile oil.—The dose of this emulsion is grt. x to ʒij . *Almond paste* is sold in the shops for softening the skin and preventing chaps. Dr. Paris¹ gives the following recipe for making it: Bitter Almonds, blanched, ʒiv ; the White of an Egg, Rose Water, and Rectified Spirit, p. æ., as much as may be sufficient.

1. CONFECTIO AMYGDALÆ, L; *Conserva Amygdalarum*, E; *Almond Confection*.—(Sweet Almonds ʒviiij ; Powder of Gum Arabic ʒj ; Sugar ʒiv . The almonds being first macerated in cold water, and their pellicles removed, rub them through a fine metallic sieve; then beat all the ingredients until thoroughly incorporated. The process of the two Colleges is essentially the same. The *London College* adds, that this confection can be preserved unaltered for a longer time, if the almonds, gum Arabic, and sugar, are separately powdered, and afterwards mixed. Then, whenever the confection is to be used, beat all the ingredients together until they are thoroughly incorporated.)—Almond confection, prepared without water, is not more apt to spoil or become rancid than when the ingredients are separately powdered, and subsequently mixed; but if, in order to soften the mass, a little water be added, it then soon becomes mouldy or rancid, or both.² The only use of almond confection is in the preparation of the emulsion.

2. MISTURA AMYGDALÆ, L. E. D. [U. S.] *Lac Amygdalæ*; *Almond Emulsion*; *Almond Milk*.—(Almond Confection ʒiiss ; Distilled Water Oj. Gradually add the water to the confection, while rubbing, until they are mixed; then strain through linen, L. The *Edinburgh College* employs ʒij of the Confection to Oij of Water, and strains the mixture through linen or calico; or they direct it to be prepared by the following process: "Sweet Almonds ʒj and ʒij ; Pure Sugar ʒv ; Mucilage ʒʒss ; Water Oij. Steep the almonds in hot water and peel them, and proceed as for the *Mistura Acaciæ*."—The *Dublin College* prepares it as follows: Sweet Almonds, blanched, ʒv ; Gum Arabic, in powder, ʒj ; Refined Sugar ʒij ; Distilled Water ʒviiij . Rub the almonds with the sugar and gum, adding gradually the water, then strain.)—Notwithstanding that the formulæ of the three Colleges are different, none of them precisely agree with that which is in common use. No one who wishes to procure good almond milk would prepare it with the confection, on account of the changes which this preparation suffers by being kept. Powdered gum Arabic is, for ordinary purposes, a more convenient and ready ingredient than mucilage, and does not undergo any change by keeping. The following formula, which is similar to that of the *Dublin College*, yields a preparation identical with that of the *London College*: Sweet Almonds ʒiv ; Powdered Gum Arabic ʒj ; White Sugar ʒij ; Water ʒʒviss . Having blanched the almonds, beat them with the sugar and gum, the water being gradually added. [This is nearly the formula of the *U. S. Pharm.*, which orders of Gum Arabic ʒss and Water ʒviiij .] Almond milk agrees in many of its properties with animal milk. Thus it is white; when examined by the microscope, it is seen to consist of myriads of oleaginous globules, suspended in water by the aid of an albuminous principle (emulsin) and sugar; and, lastly, it agrees with milk, in possessing nutritive and emollient qualities. It is used as a demulcent and emollient in pulmonary affections, to appease cough and allay irritation; and in inflammatory affections of the alimentary canal or of the urinary organs. It is an excellent vehicle for other remedies; as for the saline refrigerants (nitre, for example) in febrile cases, for expectorants and paretics (squills, ipecacuanha, opiates, &c.) in pulmonary affections, for sudorifics (emetic tartar, for example) in febrile and inflammatory cases, for alkalies and their carbonates in affections of the urino-genital organs, and for hydrocyanic acid in gastro-

¹ Pharmacologia.² Brande, *Dict. of Pharm.* 56.

dynia and pulmonary disorders. Acids and alcohol (hence tinctures) coagulate the emulsin, and cause almond mixture to separate into a kind of curd and whey; a change which also takes place spontaneously when the mixture has been kept, and which is accompanied with the development of free acid. In cases where the hydrocyanic acid is admissible, the bitter almond may be used.—The dose of almond emulsion is fʒj or fʒij, or *ad libitum*.

3. **OLEUM AMYGDALÆ, L.** [U. S.]; *Almond Oil*; *Oil of Sweet Almonds*.—(Obtained by expression from either bitter or sweet almonds; usually from the former, on account of their cheapness, as well as of the greater value of their residual cake.)—The average produce is from 48 to 52 lbs. from 1 cwt. of almonds. When recently expressed it is turbid, but by rest and filtration becomes quite transparent. It usually possesses a slightly yellow tinge, which becomes somewhat paler by exposure to solar light. It is inodorous or nearly so, and has a purely oleaginous bland taste. It congeals less readily by cold than olive oil. Braconnot states that at 14° F. it deposits 24 per cent. of *margarine* (*margarate of glycerine*) which fuses at 43° F. The residual *oleine* (*oleate of glycerine*) did not congeal at the greatest degree of cold. The accuracy of these statements has, however, been called in question. Its sp. gr. would appear to vary; Brandis found it 0.911, Brisson 0.917, Saussure 0.920, at 53° F. Sulphuric ether dissolves it. Six parts of boiling, or twenty-five parts of cold alcohol, are required to dissolve one part of this oil.

Proximate Composition.		Ultimate Analysis.	
Braconnot.		Saussure.	
Oleine	76	Carbon	77.403
Margarine (Stearine of Braconnot)	24	Hydrogen	11.491
		Oxygen	10.828
Almond Oil	100	Nitrogen [loss]	0.282
		Almond oil	100.000

The nitrogen mentioned in Saussure's analysis is probably an error.

Almond oil is said to be adulterated with *teel oil*.

It possesses the dietetical and medicinal properties of the other fixed oils. Its local action is emollient. Swallowed in moderate doses it is nutritive, but difficult of digestion. In large doses it acts as a mild laxative.

Almond oil may be employed for the same purposes as olive oil. Mixed with an equal volume of syrup of violets, or syrup of roses, it is given to new-born infants as a laxative. It is sometimes used with gum (in the form of mucilage), alkalies, or yolk of egg, to form an emulsion, which is used in the same cases as the *mistura amygdalæ*. To assist in allaying troublesome cough, it is not unfrequently administered in the form of linctus, with confection of dog-rose, and syrup of poppies.

4. **OLEUM AMYGDALÆ AMARÆ**; *Oleum Amygdalæ amaræ destillatum*; *Oil of Bitter Almonds*; *Essential Oil of Almonds*.—(Obtained by submitting bitter almond cake [left after the expression of the fixed oil from bitter almonds] to distillation with water, either alone, or more usually with salt. To increase the quantity of volatile oil, Geiger recommended the cake to be macerated in the water for 24 hours before distillation.) The *theory* of this process is curious. Chemists formerly supposed that the volatile oil resided in the bitter almond, and that by distillation it was merely volatilized, and subsequently condensed. But in opposition to this view may be urged the following facts:—

1. Neither bitter almonds, nor their residuary cake, yield any volatile oil by pressure, yet we know that the volatile oil is soluble in the fixed oil, and, therefore, when the latter was expressed it ought to contain traces of the volatile oil, if this existed in the bitter almonds.

2. They yield no oil when digested in alcohol or in ether, though the volatile oil is soluble in both of these liquids.

3. Alcohol extracts from bitter almond cake, sugar, resin, and *amygdalin*. When the latter substance has been removed, the cake is no longer capable of furnishing the volatile oil by distillation.

4. Ether extracts no amygdalin from bitter almond cake; and the cake left after digestion in ether yields the volatile oil by distillation with water.

These facts, then, prove that the volatile oil does not reside in the bitter almond, but is formed by the action of water on some of the constituents of these seeds. When bitter almonds are deprived of amygdalin, they are incapable of yielding the volatile oil; so that it is this principle which enables them to yield it. But amygdalin, with water only, produces no oil; hence the presence of some other substance is necessary. Wöhler and Liebig¹ have shown that this other substance is emulsin (albumen), and that, by the mutual reaction of amygdalin, emulsin, and water, we obtain the volatile oil of bitter almonds and hydrocyanic acid. But it appears that sugar, and some other substance (probably a compound of formic acid and altered emulsin), are simultaneously developed. These ingredients are, probably, all yielded by the amygdalin, the operation of emulsin on which has been compared to that of yeast on sugar and water. It will be seen by the following table (drawn up by Wöhler and Liebig), that amygdalin contains the elements of hydrocyanic acid, volatile oil of bitter almonds, sugar, formic acid, and water:—

	Atoms of			
	Carbon.	Hydrogen.	Nitrogen.	Oxygen.
1 atom of hydrocyanic acid	2	1	1	0
2 atoms volatile oil of bitter almonds	28	12	0	4
1 atom of sugar	6	5	0	5
2 atoms of formic acid	4	2	0	6
7 atoms of water	0	7	0	7
1 atom of Amygdalin	40	27	1	22

The essential oil of bitter almonds of the shops, possesses the following properties. It is highly poisonous, has a golden-yellow colour (by rectification it may be rendered temporarily colourless), an agreeable odour (usually compared to that of hydrocyanic acid, but which, in fact, bears but little resemblance to it), and an acid, bitter taste. It is combustible, and burns with a white flame. Its sp. gr., though always greater than that of water, probably varies somewhat. I find that a sample, which had been prepared for about eight months, had the sp. gr. of 1.0836. It is soluble in alcohol and ether. Oil of vitriol forms with it a magnificent crimson-red thick liquid, which, on the addition of water, yields a yellow emulsion.

[Some recent observations by Mr. Redwood² show that the sp. gr. of this oil varies greatly according to the temperature at which it is obtained; he examined specimens of sp. gr. 1052.4 to as high as 1082.2. This variation has sometimes been attributed to the presence of spirit added for adulteration; but no spirit could be detected. The oils of lighter sp. gr. appeared to contain the purest hydruret of benzule; while, from the reaction of strong sulphuric acid, it would appear that benzoine is present in considerable proportion in the heavier specimens.—Ed.]

Oil of bitter almonds, as found in commerce, is a mixture or compound of *hydruret of benzule*, *hydrocyanic acid*, a little *benzoic acid*, *benzoine*, *benzimide*, and probably other substances.

a. HYDRURET OF BENZULE.—This is obtained by forming the oil into a thin paste with hydrate of lime, chloride of iron, and water, and redistilling. It is a limpid colourless oil, whose sp. gr. is 1.013, and whose odour and taste are scarcely different from those of the ordinary oil. Robiquet found it innocuous, but Vogel, and more recently Liebig, declare that it still retains its poisonous properties. In some earlier experiments which I made on this subject, I found it to be highly poisonous, though I could not detect an atom of hydrocyanic acid in it. After the sample had been kept a few months, however, I readily detected the acid in it by the potash and iron test. By a second and third rectification I completely deprived it of all traces of the acid; and I then found that four drops of it, given to a small rabbit, had no more effect than the same quantity of any other volatile oil; that is, the animal appeared dull for a few minutes, and the respiration was quickened. Hydruret of benzule is composed of $C^{14}H^6O^2$. Certain changes which it undergoes are best explained by assuming that this oil is a compound of the

¹ Journ. de Pharm. xxiii.

² Pharm. Journ. vol. xi. p. 486.

base of benzoic acid and hydrogen. To this base, whose composition is $C^{14}H^5O_2$, the name of *Benzule* or *Benzoyl Bz*, has been given; so that the oil is the *hydruret of benzule*, $C^{14}H^5O_2 + H$ or BzH , and its proximate and ultimate composition is as follows:—

Proximate Composition.			Ultimate Composition,			
	Atoms.	Eq. Wt.		Atoms.	Eq. Wt.	Per Cent.
Benzule	1	105	Carbon	14	84	79.24
Hydrogen	1	1	Hydrogen	6	6	5.66
	—	—	Oxygen	2	16	15.10
Hydruret of Benzule	1	106		1	106	100.00

By exposure to the air it absorbs 2 eq. oxygen, and is converted into hydrated benzoic acid, $C^{14}H^5O_3 + Aq.$ or $BzO.HO$.

β HYDROCYANIC ACID.—The presence of hydrocyanic acid in the essential oil of bitter almonds may be detected by the usual tests, especially by potash and a salt of iron. The quantity of this acid is differently stated by different authorities, and is, probably, not uniform. Schrader¹ got, from an old sample, 8.5 per cent., and from a new sample, 10.75; but Goppert obtained, from another specimen, so much as 14.33 per cent. Water in which the oil has been washed gives evidence of the presence of hydrocyanic acid by the potash and iron test before referred to.

γ. BENZOIC ACID, BzO.—This is formed by the action of the oxygen of the atmosphere on hydruret of Benzule, as above mentioned. It is more readily produced in the pure hydruret than in raw oil of bitter almonds.

δ. BENZOIN; Camphor of Oil of Bitter Almonds—Liebig² states that this is a constituent of oil of bitter almonds. It is a crystalline substance usually obtained by the action of alkalis on the oil. It cannot be procured from hydruret of benzule (with which it is isomeric) unless hydrocyanic acid be present. It is soluble in boiling alcohol. Oil of vitriol also dissolves it with a violet-blue colour; if the solution be heated it becomes brown, green, and at last black, with disengagement of sulphurous acid.

ε. BENZAMIDE.—This separates from oil of bitter almonds under certain circumstances. Its formula is $C^{14}H^7NO_2$ or $BzAD$. It is soluble in alcohol. Nordhausen sulphuric acid dissolves it, assuming a deep indigo colour; if moisture be present the colour is at first emerald green. By the action of potash and a little alcohol it evolves ammonia and forms benzoate of potash.

A *crystalline matter* is frequently deposited by oil of bitter almonds, when it has been kept for some time. Exposure to the air, by which the oil is enabled to absorb oxygen, and the removal of hydrocyanic acid from the oil, facilitate the deposition. In 1822, Grischow and Bahlmann,³ and, in 1823, Stange,⁴ declared the crystals to be those of benzoic acid; a statement which was confirmed, in 1830, by Robiquet and Boutron.⁵ I have met with three kinds of crystalline deposit, differing essentially from each other and from benzoic acid.

1st. One of these is characterized by the *emerald green* colour which it produces when dropped into oil of vitriol. In a few minutes, however, the green changes to red. This deposit is orange yellow, soluble in boiling water, alcohol, and ether; when the alcoholic or ethereal solutions cool, numerous white, light, pearly crystalline plates (resembling crystalline boracic acid) are deposited. If these white crystals be dropped into oil of vitriol, they also become emerald-green, but very slightly so; the mother liquor is rendered much more intensely green by oil of vitriol. Boiled with caustic potash they give out ammonia. By keeping for two years in a stoppered bottle, both the raw and purified crystals lost the property of becoming green by oil of vitriol; they now became red on the addition of this liquid; and the crystals, on being redissolved in alcohol and recrystallized, were scarcely coloured on the addition of oil of vitriol.

From raw oil of bitter almonds washed with solution of potash I have obtained, at the end of twenty-four hours, crystals which, like the above, became green on the addition of oil of vitriol.

2d. A second crystalline deposit is characterized by the *cherry-red* colour which it assumes when dropped into oil of vitriol, and by its not evolving ammonia when boiled with caustic potash. Its appearance resembles solid oil of anise. When dissolved in boiling alcohol and recrystallized, it yields silky prismatic crystals somewhat similar to those of nitrate of ammonia. At the end of two years it had almost lost its quality of being reddened by oil of vitriol; but when boiled with this liquor it gave out a crystalline sublimate. Heated with solution of potash it evolved faint traces of ammonia.

3d. The third⁶ kind of deposit I did not receive until after it had been digested in alcohol.

¹ Quoted by Dr. Christison, *Treat. on Poisons*.

² *Berl. Jahrb. d. Pharm.* 1832, p. 158.

³ *Ann. de Chim. et de Phys.* xl. 364.

⁴ *Turner's Chemistry*, 7th edit. p. 785.

⁵ *Buchner's Repert.* xiv. 329; xvi. 82.

⁶ For specimens of this, as well as of the first kind of deposit, I am indebted to Mr. Whipple.

A short notice of it has been given by Dr. Letheby.¹ The crystals are small, acicular, and lemon-yellow; they dissolve in oil of vitriol, forming a yellow or orange-coloured solution. They are insoluble in water and alcohol. When heated they fuse, but, unlike the two preceding deposits, do not sublime. They do not evolve ammonia when heated with a solution of caustic potash. At the end of two years these crystals were unchanged. In all the cases in which they are found the oil had been put aside contaminated with water.

The *Volatile Oil of Bitter Almonds* is a most potent poison, acting as rapidly as the ordinary hydrocyanic acid of the shops, and giving rise to similar symptoms. A single drop has killed a cat in five minutes.² Sir B. Brodie, happening to touch his tongue with a probe which had been dipped in the oil, suffered, almost instantaneously, an indescribable sensation at the pit of the stomach, feebleness of the limbs, and loss of power over the muscles. These effects, however, were quite transient. Several cases of poisoning with it are recorded. The best detailed is that related by Mertzdorff (quoted by Dr. Christison): "A hypochondriacal gentleman, 48 years old, swallowed two drachms of the essential oil. A few minutes afterwards, his servant, whom he sent for, found him lying in bed, with his features spasmodically contracted, his eyes fixed, staring, and turned upward, and his chest heaving convulsively and hurriedly. A physician, who entered the room twenty minutes after the draught had been taken, found him quite insensible, the pupils immovable, the breathing stertorous and slow, the pulse feeble, and only thirty in a minute, and the breathing exhaling strongly the odour of bitter almonds. Death ensued ten minutes afterwards." Another case of poisoning with this oil occurred a few years since in Aldersgate Street: a lady intending to take beech-nut oil, for worms, swallowed (by mistake) oil of bitter almonds, sold to her by a druggist, who supposed she inquired for peach-nut oil. Recovery has occurred, in one case, after about half an ounce (?) of the oil had been swallowed.³

[Mitscherlich⁴ has experimented on the effects of this oil on dogs and rabbits; he found it poisonous even when quite free from hydrocyanic acid. He found also, as stated by Wohler and Frerichs, that it is oxidized in the system when given in small quantity, and is converted into hippuric acid in the urine. In large doses, however, it escapes unchanged into the urine.—ED.]

In this country, essential oil of bitter almonds is not employed in medicine. It is applicable in the same cases that hydrocyanic acid is employed in. But it must not be forgotten that, though its strength is somewhat variable, it is in general four times the strength of official hydrocyanic acid. The dose of it is a quarter of a drop to a drop and a half in an emulsion. It is extensively employed for flavouring by the cook and confectioner; and by the perfumer for scenting toilet-soap, and for other purposes.

ESSENCE OF BITTER ALMONDS; ALMOND FLAVOUR—This term is sometimes applied to the essential oil, and sometimes to a solution of the oil in rectified spirit. Two fluidrachms of the oil and six fluidrachms of rectified spirit form a useful essence for flavouring and scenting. [It is a dangerous preparation, as it still holds hydrocyanic acid dissolved. Half an ounce of it has been known to destroy the life of an adult.—ED.]

259. PERSICA VULGARIS, Miller.—THE PEACH.

Amygdalus Persica, Linn.
Sex. Syst. Icosandria, Monogynia.

[Although no longer to be found in the British Pharmacopœias, we have retained the author's remarks upon this fruit.—ED.]

HISTORY.—Both Dioscorides⁵ and Pliny⁶ speak of the peach; the former terms it *περσικόν μᾶλον*; the latter *malum persicum*.

¹ *Lond. Med. Gaz.* xxvi. 67.

² *Journ. Chim. Méd.* t. vi. 2de ser. p. 92.

³ *Lab. i.* cap. 164.

⁴ Brodie, *Phil. Trans.* 1811, p. 178.

⁵ *Pharmaceutic Journal*, vol. x. p. 83.

⁶ *Hist. Nat. lib.* xv. cap. 11, *et seq.* ed. Valp.

BOTANY. Gen. Char.—The same as *amygdalus*, except that the *drupe* is very fleshy. *Epicarp* either velvety or quite smooth. *Putamen* (stone) extremely rugose, with furrows. (De Cand.)

Fig. 359.



The Peach.

Sp. Char.—*Fruit tomentose.* (De Cand.)

A small tree. *Leaves* lanceolate, serrate or crenate, with or without glands. *Flowers* roseate, large or small.¹ Both flowers and kernels exhale the bitter almond odour.

Two varieties of the peach are usually made. These are admitted by De Candolle:—

a. Melters or Free-stones.—Flesh separating from the stones.

β. Cling-stones or Pavies.—Flesh adherent to the stone.

The *Nectarine* (*Persica lævis*, De Cand.) is distinguished from the peach by its smooth fruit. This trivial distinction

leads many botanists to regard these two fruits as varieties of the same species.

Hab.—Native of Persia. Cultivated in gardens. Flowers in April or May.

DESCRIPTION.—*Peach leaves* (*folia persicæ*) have the peculiar odour and taste of the bitter almond. The *kernels* (*semina persicæ*) closely resemble the latter, both in appearance and properties, but are smaller. The *flowers* (*flores persica*) lose the greater part of their odour by drying.

COMPOSITION.—The *leaves* have not been analyzed. They yield, by distillation, a volatile oil (*oleum folii persicæ*), which is yellow, heavier than water, and contains hydrocyanic acid.² After eight years a crystalline substance was found on the water.³ The non-ligneous extremities of the *twigs* of the peach-tree yielded Gauthier⁴ 1.92 per cent. of very volatile oil, which was heavier than water. Berard⁵ analyzed the juice of the peach, both in the ripe and unripe states; the constituents were *colouring matter, sugar, gum, vegetable fibre, albumen, malic acid, lime, and water.*

PHYSIOLOGICAL EFFECTS.—The highly palatable *flesh* of the peach is nutritious (on account of its sugar, gum, &c.), and slightly refrigerant (from the malic acid which it contains). Taken in moderate quantities it is wholesome, but if eaten too freely, it is apt to disorder the bowels. The *kernels*, the *blossoms*, the *leaves*, and the *bark*, possess poisonous properties. The flowers, as well as the leaves, in the form of infusion, have been used to purge and destroy intestinal worms, especially in children;⁶ but their employment has sometimes been attended with fatal results. Bertrand⁷ says that a child, eighteen months old, experienced convulsions, vomiting, and bloody diarrhœa, from the use of a strong decoction of the flowers; and Coullon⁸ states that an elderly gentleman, having partaken of a salad of the flowers, was seized with giddiness, violent purging, convulsions, and stupor, and died in three days. The irritation of the alimentary canal, manifested by vomiting and purging, and the slow death, distinguish the operation of peach-flowers from that of hydrocyanic acid. The same author⁹ also states that the peach-bark proved injurious to a cock, and caused difficulty of breathing, and purging.

USES.—The *fruit*, both fresh and preserved, is employed as a dessert. Its use is objectionable in gouty persons, and in those whose bowels are easily disordered. When stewed with sugar, it may be given as a mild laxative to convalescents. The *kernels* may be used as the bitter almond. The *blossoms* are scarcely ever administered in this country; but they have been recommended as a vermifuge. The *leaves* are sometimes employed by the cook and liqueur-maker, for flavouring. They

¹ See London, *Encycl. of Gardening*.

² Brugnatelli, *Ann. Chem.* xvi. 96.

³ Thomson, *Org. Chem.* 890.

⁴ Costet et Willmet: quoted by Murray, *App. Med.* iii. 245.

⁵ Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iv. S. 190.

⁶ Wibmer, *op supra cit.*

⁷ Guélin, *Handb. d. Chem.* ii. 400.

⁸ *Journ. de Pharm.*

⁹ Christison, *Treatise on Poisons*, p. 726.

have also been used as a substitute for China-tea.¹ They have been recommended as a vermifuge, and more recently to allay irritation of the bladder and urethra.²

ADMINISTRATION.—The dose of *peach-blossoms* is half an ounce of the fresh, or a drachm of the dried flowers, infused in water.³ The dose of the *infusion of peach-leaves* (prepared by digesting 3ss of the dried leaves in Oj of boiling water) is f3ss, three times a day.

260. PRUNUS DOMESTICA, Linn. L. E. D.—THE PLUM TREE.

Sex. Syst. Icosandria, Monogynia.

(Fructus præparatus, L.—Dried fruit, E.—Fructus siccatus, D.)

HISTORY.—Dioscorides⁴ calls this tree the *κόκκυμυρία*, while the fruit he terms *κοκκύμυλον*.

BOTANY. **Gen. Char.**—*Drupe* ovate or oblong, fleshy, quite smooth, covered with a pruinose powder. *Putamen* (stone) compressed, acute on both sides, somewhat furrowed at the edges, otherwise smooth. Young *leaves* convolute. *Pedicels* umbellato-fasciculate, 1-flowered, evolved before or after the leaves. (De Cand.)

Sp. Char.—*Flowers* almost solitary. *Leaves* lanceolate-ovate, convolute. *Branches* not spinous. (De Cand.)—A small tree. *Flowers* white.

Gardeners cultivate several hundred varieties.⁵ De Candolle admits the following varieties:—

- a. *Armenioïdes*, including the *Mirabelle Plum*.
- β. *Claudiana*, including the *Green Gage*.
- γ. *Myrobalana*, including the *Myrobalan Plum*.
- δ. *Damascena*, including the *Damask Plum*.
- ι. *Turonensis*, including the *Orleans Plum*.
- ζ. *Juliana*, yields the *Officinal Prune*.
- η. *Catharinea*, including the *St. Catharine Plum*.
- θ. *Aubertiana*, including the *Magnum Bonum* or *Mogul Plum*.
- ι. *Prunealina*, including the *Damson*.

Hab.—South of Europe. Cultivated in gardens and orchards.

DESCRIPTION.—The dried fruits of the *Prunus domestica* are called *prunes* (*fructus siccatus pruni*; *drupæ siccatae pruni*). In warm countries they are dried on hurdles by solar heat; but in colder climates artificial heat is employed. In France both methods are adopted; the fruit being exposed to the heat of an oven and to that of the sun, on alternate days. *Table prunes* are prepared from the larger kinds of plum—as the Saint Catharine and the Reine-Claude (Green Gage); *Medicinal prunes* from the Saint Julien (*P. domestica*, var. ? *Juliana*). The former have an agreeable, very sweet taste; the latter are somewhat austere. They are principally imported from Bourdeaux. The part employed in medicine is the *pulp* (*pulpa pruni*).

COMPOSITION.—John⁶ analyzed the Mirabelle Plum, and Berard the Reine-Claude (Green Gage), both in the ripe and unripe states.⁷ The constituents of the ripe fruit, according to the last-mentioned chemist, are, *sugar* 11.61, *gum* 4.85, *albumen* 0.93, *malic acid* 1.10, *vegetable fibre* 1.21, *lime* a trace, *water* 80.24 [loss 0.06].—*Pectin* is also a constituent of these fruits.

PHYSIOLOGICAL EFFECTS.—Fresh, ripe plums, taken in moderate quantities, are wholesome and nutritive; but in large quantities they readily disorder the bowels. The immature fruit still more easily excites ill effects. The medicinal prune is a mild laxative.

USES.—The finer kind of plums are employed at the table as a delicious dessert; the inferior qualities are used in pies, tarts, conserves, and sweetmeats. The larger prunes are employed at the table as a dessert; the medicinal prunes are employed

¹ Murray, *App. Med.*

² Murray, *op. supra cit.*

³ Don-Syst. of Gard. ii. 499) mentions 270 varieties.

⁴ Gmelin, *Handb. d. Chem.* ii. 1269.

⁵ See also *Lond. Med. Rev.* vol. iv. p. 81, Lond. 1800.

⁶ Lib. i. cap. 174.

⁷ Thomson, *Org. Chem.* 690.

as an agreeable and mild laxative for children, and during convalescence from febrile and inflammatory disorders. They are sometimes added to cathartic decoctions or infusions (as *infusion of senna*), to improve the flavour, and promote the purgative effect. They enter into the composition of the *confection of senna*.

261. CERASUS LAURO-CERASUS, Loisel.—THE COMMON OR CHERRY LAUREL.

Prunus Lauro-cerasus, Linn. *D. E.*

Sez. Syst. Icosandria, Monogynia.

(Leaves, *E.*—Folia, *D.*)

HISTORY.—Belonius terms this plant the *Cerasus trapezantina*.¹ It was introduced into Europe, from Trebizonde, in 1576.

BOTANY. *Gen. Char.*—*Drupe* globose or umbilicate at the base, fleshy, quite smooth, not covered with a pruinose powder. *Nucleus* (stone) somewhat globose, smooth. *Young leaves* conduplicate. *Pedicels* 1-flowered or ramose. (De Cand.)

Sp. Char.—*Racemes* shorter than the leaves. *Leaves* ovate-lanceolate, remotely serrate, with two or four glands beneath. *Fruit* ovate, acute. (De Cand.)

An evergreen *under shrub*. Smooth in every part. *Leaves* short-stalked, coriaceous, shining. *Petals* roundish, spreading white. *Fruit* black, the size of a small cherry.

Hab.—Trebizonde. Common in gardens everywhere.

DESCRIPTION.—Cherry-laurel leaves (*folia lauro-cerasi*) have scarcely any odour until bruised, when they give out the characteristic or bitter almond odour of the plant. Their taste is very bitter, aromatic, and slightly astringent. By drying they lose their odour, but retain their flavour. Their watery infusion is rendered green by the sesquichloride of iron.

COMPOSITION.—I am unacquainted with any complete analysis of cherry-laurel leaves. They were imperfectly examined in 1797, by L. J. Spandaw du Celliée.² In 1802, Schrader³ discovered hydrocyanic acid in the volatile oil obtained from them. The recent researches into the origin of the volatile oil of the bitter almond (see *ante*), render it probable that the volatile oil of the cherry-laurel does not pre-exist in the leaves. The supposed constituents of cherry-laurel leaves are *amygdalin* (probably, according to Wöhler and Liebig, though they failed to procure it), *resin* (Spandaw), *myricin* (the shining appearance of the leaves is, perhaps, owing to this), *chlorophyll* or green colouring matter, *extractive*, *tannic acid*, *ligneous fibre*, and *water*.

VOLATILE OIL OF THE CHERRY-LAUREL (*Oleum Lauro-cerasi*).—By distillation with water, cherry-laurel leaves yield a volatile oil and a distilled water (*aqua lauro-cerasi*). As the oil, like the volatile oil of bitter almonds, contains both hydrocyanic acid and hydruuret of benzule, it is natural to suppose that the two oils are produced in a similar manner. And though they did not succeed in procuring amygdalin, MM. Wöhler and Liebig⁴ think its presence in cherry-laurel leaves highly probable; but what substance effects its decomposition has not yet been ascertained.

Cherry-laurel oil is of a pale yellow colour, and heavier than water. It attracts oxygen from the air, and deposits benzoic acid. Oil of vitriol colours it red. It contains hydrocyanic acid, which may be detected by an alkali and a ferruginous salt. The quantity, according to Schrader, is 7.66 per cent.; but Göppert declares it to be 2.75 per cent.⁵ It appears, therefore, to be a weaker poison than the oil of bitter almonds, with which, according to Robiquet,⁶ it agrees in all its chemical properties.

PHYSIOLOGICAL EFFECTS.—Most parts of the plant, but more especially the leaves and seeds, possess poisonous properties.

a. On Vegetables.—The distilled water of the cherry-laurel destroys plants, like hydrocyanic acid. Göppert asserts that its poisonous operation does not depend on

¹ Sprengel, *Hist. rei herb.* i. 377.

² *Ibid.* S. 151.

³ Christison, *On Poisons*, p. 722.

⁴ Pfaff, *Mat. Med.* Bd. v. S. 152.

⁵ *Journ. de Pharm.* xxiii. 111.

⁶ *Journ. de Pharm.* viii. 304.

the small quantity of this acid which it contains, but on some poisonous quality peculiar to it; for its activity is greater than that of water containing the same quantity of hydrocyanic acid.¹

3. *On Animals*.—The effects of cherry-laurel water on animals have been examined by a considerable number of observers.² Of these it will be sufficient to mention the names of Madden,³ Brown Langrish,⁴ Fontana,⁵ and Orfila.⁶ It appears, says Dr. Christison, that whether cherry-laurel water is introduced into the stomach or into the anus, or into the cellular tissue, or directly into the vein, it occasions giddiness, palsy, insensibility, convulsions, coma, and speedy death; that the tetanic state brought on by the pure acid is not always so distinctly caused by cherry-laurel water; and that tetanus is most frequently induced by medium doses.⁷ Cherry-laurel oil acts on animals as a powerful poison in the dose of a few drops; the symptoms which it excites being similar, if, indeed, they be not identical, with those induced by the volatile oil of bitter almonds.

γ. *On Man*.—Liqueurs, sweetmeats, creams and puddings, flavoured with the cherry-laurel, have oftentimes acted injuriously, and even proved fatal. Where death occurred, the symptoms were similar to those caused by hydrocyanic acid; viz. painful sensation at the stomach, sudden insensibility, and death within a few minutes. Convulsions, however, have not been frequent. In the case referred to by Dr. Madden,⁸ in which brandy, mixed with a fourth part of cherry-laurel water, proved fatal, there was no vomiting, purging, or convulsions. But in the instances mentioned by Fodéré,⁹ the individuals expired in convulsions. The effects of medicinal doses of cherry-laurel water are stated to be similar to those of small doses of hydrocyanic acid.

USES.—Cherry-laurel leaves are not unfrequently employed by the cook for flavouring. Though the distilled water of the cherry-laurel is contained in the Edinburgh and Dublin Pharmacopœias, yet it is rarely employed in medicine in this country. It is applicable to all the cases for which hydrocyanic acid has been used. It has been used as a sedative narcotic in tic douloureux, phthisis pulmonalis, spasmodic cough, and palpitation of the heart.

AQUA LAURO-CERASI, E. D.; *Water of Cherry Laurel; Laurel Water*.—(Fresh Leaves of the Common Laurel lbj; Water Oiiiss. Upon the leaves, chopped, and crushed in a mortar, macerate the water for 24 hours, and then draw over a pint of liquid by distillation, using a Liebig's condenser, and chloride of zinc bath. Filter the product through paper, and preserve it in a well-stopped bottle, *D*. The compound spirit of lavender is added as a colouring ingredient, by the Edinburgh College, to prevent the preparation being mistaken for common water. In other respects the process is essentially the same as in the Dublin Pharmacopœia.)—Dose, fʒss to fʒj. The strength, and, therefore, the dose, are, however, liable to considerable variation. Fouquier¹⁰ has, in some cases, given twelve ounces during the day, without any evident effect.

262. CERASUS SEROTINA, De Cand.—WILD CHERRY.

Sex. Syst. Icosandria, Monogynia.

(*Prunus Virginiana*, U. S. Wild Cherry Bark.)

Not a little confusion has existed among botanists with respect to the name of this tree, from its having been confounded with a species closely allied to it, the *C. virginiana* of De Candolle, or Choke Cherry, which latter was described by Linnaeus under the title of *Prunus virginiana*, but by which he was supposed to have designated the *Wild Cherry*, and hence the adoption of that designation for the plant under consideration; the name *P. serotina* being given to the other species.

¹ De Candolle, *Phys. Vég.* 1358—9.

² *Phil. Trans.* for 1731.

³ *Treatise on the Venom of the Viper*, &c. 1787.

⁴ Christison, *op. cit.* p. 723.

⁵ Orfila, *Toxicol. Gén.*

⁶ See Wibmer, *Wirk. d. Arzneim.* Bd. ii. S. 91.

⁷ *Phys. Exp. upon Brutes*, &c. 1746.

⁸ *Toxicol. Gén.*

⁹ *Phil. Trans.* for 1731.

¹⁰ Richard, *Elém. d'Hist. Nat.* ii. 447.

The transposition of names originated with Michaux, who mistook the *Wild Cherry* for the *P. virginiana*, and called it *Cerasus virginiana*. The error has been fully explained and corrected from De Candolle by Drs. Torrey and Gray in the *Flora of North America*. The authors of the last edition of the *United States Pharmacopœia*, have not thought it expedient at present to change the official title for the bark of the tree, as it has been sanctioned by custom for so long a period, as to render it almost an impossibility to introduce a new one.

BOTANY. Gen. Char.—As in *Cerasus Lauro-Cerasus*.

Sp. Char.—*Leaves* (rather coriaceous) oval-oblong or lanceolate-oblong, acuminate, glabrous, or bearded along the midrib beneath, smooth and shining above, finely serrate, with adpressed or incurved callous teeth; *petioles* (or base of the leaf) mostly with two or more glands; racemes elongated, spreading; *petals* broadly obovate; *drupes* globose, purplish black. (*T. & G. Flor. North Amer.* p. 411.)

Hab.—The Wild Cherry is an inhabitant of the United States, where it is disseminated from Canada to Florida, and through the Western States.

It varies in height from twenty-five to eighty or more feet, attaining its extreme proportions in the south-western portion of the Union. The *leaves* are 2—4 inches long; *racemes* 2—5 inches in length, and nodding at their termination. *Flowers* white and fragrant, appearing in May. The bark of the tree is of a dark ashy hue on the trunk, where it is rough; smooth and dark upon the branches. The epidermis is readily separable, and peels off when detached circularly, leaving the green cellular tissue beneath. By this character it can be detected in the forests. The wood is hard, and valuable in the construction of furniture. The fruit has a sweet, somewhat prussic, and slightly bitter taste. It is used for flavouring liquors.

The bark of the branches or of the root is employed for medicinal purposes. The latter is regarded as best. It is collected by the herb-venders, and brought into the market in pieces or fragments several inches long, and from half an inch to two in width. From drying it becomes somewhat curved laterally. It is destitute of the epidermis, of a reddish-brown colour, brittle and pulverizable; fracture short, and presenting grayish surfaces. When fresh the odour is prussic, which is in a measure lost by drying, but regained by maceration. The taste is aromatic, prussic, and bitter.

COMPOSITION.—The first satisfactory analysis of this bark was made by Mr. Stephen Procter (*Journal of Philad. Col. of Pharmacy*, vol. vi. p. 8), who found it to contain starch, resin, gallic acid, tannin, fatty matter, lignin, red colouring matter, salts of lime, potassa, and iron. By distilling the bark with water, a volatile oil was obtained, associated with hydrocyanic acid. More recently (*op. cit.* vols. ix. p. 300, and x. p. 197), Mr. William Procter has shown that the volatile oil is composed of *hydruret of benzule* and hydrocyanic acid, like oil of bitter almonds, and that they do not pre-exist in the bark, but are products of the decomposition of *amygdalin*; the same principle that exists in the bitter almond, by the reaction of emulsin.

OIL OF WILD CHERRY.—This oil has a light straw-colour, a pungent taste, and an odour strongly resembling that of bitter almonds. When deprived of hydrocyanic acid by distillation with a mixture of proto-chloride of iron, potassa, and water, it is without any poisonous properties. Its sp. gr. is 1.046.

It is presumable that bitter extractive matter exists in it, and it has been suggested that phloridzine is also a constituent. It yields its virtues to water and alcohol.

MEDICAL PROPERTIES.—Dr. B. S. Barton informs us (*Collections*, p. 11) that the leaves of this tree are poisonous to certain animals, as calves, and even the berries intoxicate different kinds of birds.

The bark is tonic and invigorating in its impression upon the stomach and the general system, but at the same time is regarded as exercising a sedative or depressing influence upon the circulation and nervous apparatus, which last effect is attributed to the action of the hydrocyanic acid.

From the experiments of Dr. Morris, who made it the subject of his inaugural dissertation (1802), it appears that the primary impression upon the pulse was an increase of rapidity, but that when it had been continued for some time, the pulse fell below the original standard, and at the same time it became fuller and stronger; in cases where some previous excitement existed, the rise of the pulse was steady, and in all his experiments, the medicine was pushed until drowsiness came on. Half-drachm doses of powdered bark were exhibited. This primary stimulant operation is concurred in by Dr. Eberle, who states, however, that when taken in large quantities and repeated frequently, it weakens the digestive powers, and produces an effect upon the action of the heart and arteries the reverse of stimulant; that in his own person he several times reduced his pulse from seventy-five to fifty strokes in a minute, by copious draughts of the cold infusion, taken several times during the day, and continued for twelve or fourteen days. (*Treat. on Mat. Med.* vol. i. p. 272.) There must certainly be considerable difference of action between the powdered bark, in which the astringent and bitter principle is concentrated, and the hydrocyanic acid with difficulty eliminated, and the cold infusion, in which the latter principle has an opportunity of being fully generated.

USES.—From its little stimulating properties, but, on the contrary, its power of allaying irritation, particularly of a nervous kind, it has been employed in a number of diseases connected with a debilitated state of the system. As a commencing tonic in the convalescence from fever or inflammatory attacks, it may frequently be ventured upon, when other roborants are inadmissible. This is especially the case where the attack of the disease has been pulmonary, and where any excitement of the circulation cannot but be prejudicial, as in Pneumonia, Bronchitis, &c. To Phthisis it is regarded as being peculiarly adapted, and by several eminent writers is highly spoken of; thus, we are informed by Dr. Eberle, that “it lessens the frequency, tension, and irritated state of the pulse; moderates the cough and profuse nocturnal perspirations; checks the diarrhoea, and sustains the general strength of the system;” the same also is the testimony of Dr. Chapman. In hectic fever, from whatever cause proceeding, analogous results may be expected.

In dyspepsia, a quieting and at the same time invigorating impression is made upon the stomach; it should, in this case, however, be but moderately employed, as large and repeated doses are prone to diminish the power of the organ. Professor B. S. Barton declares (*Collections*, p. 11) that the Wild Cherry Bark has been used with success in Intermittent Fever; this is confirmed by the statements of numerous physicians, who have been induced to try it. Dr. Eberle (*op. cit.* p. 272) employed it while residing in the country, and in the majority of cases with success. No comparison, nevertheless, can be instituted between it and cinchona.

If given in substance, the dose is from \mathfrak{zss} to \mathfrak{zij} of the powder. A decoction is decidedly objectionable, as the easily volatilized prussic acid is driven on by the heat. For ordinary purposes the best form of exhibition is the infusion.

1. *INFUSUM PRUNI VIRGINIANÆ*, U. S. *Infusion of Wild Cherry Bark.* To prepare it: Take of Wild Cherry Bark, bruised, half an ounce; Water, a pint. Macerate for twenty-four hours, and strain. This infusion may also be made by percolation. As cold water is in this preparation the vehicle, the volatile principle is not lost. It is a beautiful, clear, wine-coloured fluid, having a decided hydrocyanic flavour, and an aromatic, pleasantly bitter taste. The dose is \mathfrak{zij} , or more, repeated according to circumstances.

2. *SYRUPUS PRUNÆ VIRGINIANÆ*, U. S. *Syrup of Wild Cherry Bark.* Take of Wild Cherry Bark, in coarse powder, $\mathfrak{z}\mathfrak{v}$; Sugar lbij ; Water, a sufficient quantity. Moisten the Bark thoroughly with water, let it stand for twenty-four hours in a close vessel, then transfer it to a percolator, and pour water upon it gradually until a pint of filtered liquor is obtained. To this add the sugar, in a bottle, and agitate occasionally until it is dissolved. This preparation was introduced by Messrs. W. Procter, and J. C. Turnpenny, *Am. Journ. Pharm.* vol. xiii. p. 627, and has been employed

by the profession with advantage. It is an agreeable preparation, pleasant to the taste, and highly active. It is adapted to coughs and pulmonary affections. Dose, ℥ss, repeated.

263. ACIDUM HYDROCYANICUM DILUTUM, L. E. D., U. S.— DILUTED HYDROCYANIC OR PRUSSIC ACID.

(Acidum Hydrocyanicum, E.)

[The pharmaceutical history of this acid was placed by the author in the first volume of the former edition of this work. The alteration of the plan in the present edition, by which the Mineral Materia Medica has been entirely confined to the first volume, has led to the omission of Hydrocyanic Acid. We have selected this place for the insertion of this article, as being more appropriate than any other part of the volume which yet remains for completion.—ED.]

HISTORY.—The substance called *Prussian* or *Berlin blue* (*Caruleum Borussicum*, seu *Berolinense*) was accidentally discovered by Diesbach at the commencement of the 18th century, and various conjectures were soon offered regarding its nature. In 1746, Dr. Brown Langrish published some experiments made with laurel water, in order to investigate its effects on animals.¹ In 1752, Macquer announced that Prussian blue was a compound of oxide of iron, and some colouring principle which he could not isolate; and in 1772, Guyton Morveau concluded that this principle was of an acid nature. Scheele, in 1782, removed some of the mystery connected with Prussian blue, by obtaining *hydrous prussic acid* from it. In 1787, Berthollet ascertained this acid to be a compound of carbon, nitrogen, and hydrogen. In 1800 and 1802, Bohn and Schrader discovered it in laurel-water. Borda, Brugnatelli, and Rasori, first employed the acid in medicine, from 1801 to 1806. In 1815, Gay-Lussac obtained the acid in its pure *anhydrous* state, and explained its composition.²

SYNONYMES AND ETYMOLOGY.—It has been denominated *Prussic* (*Acidum Borussicum*), *Zootic* (*Acidum Zooticum*), or *Hydrocyanic Acid*; the first name indicates the substance (Prussian blue) from which it was obtained, the second refers to its animal origin, and the third indicates its constituents, hydrogen and cyanogen (so called from *κύανος*, *blue*; and *γεννᾶω*, *to produce*; because it is one of the constituents of Prussian blue).

NATURAL HISTORY.—Hydrocyanic acid is a product peculiar to the organized kingdom. It may be readily procured from many *vegetables*, more especially those belonging to the sub-orders *Amygdalæ* and *Pomæ*; as from Bitter Almonds, Apple-pips, the Kernels of Peaches, Apricots, Cherries, Plums, and Damsons; the Flowers of the Peach, Cherry-laurel, and Bird-cherry; the Bark of the latter, and the Root of the Mountain Ash. It is said to have been also obtained from plants of other families, as from *Rhamnus Frangula* and Ergot of Rye. In some of the vegetables now referred to, hydrocyanic acid does not exist ready formed, but is a product of the process by which it is obtained. This has been fully proved in the case of the bitter almond, and is inferred in other instances.

This acid is rarely, if ever, found in animals. One of its constituents (cyanogen) has, however, been detected, in combination with iron (forming Prussian blue), in the urine, the menstrual fluid, and the sweat; and with sulphur and potassium in the saliva. The greenish-blue discharge of some ulcers probably depends on the presence of Prussian blue. In one case I detected the presence of iron in this discharge.³

¹ *Physical Experiments upon Brutes*, Lond. 1746.

² The chemical history of hydrocyanic acid is fully detailed in Thomson's *System of Inorganic Chemistry*, vol. ii. 7th edition. The medical history of it is contained in Dr. Granville's *Hist. and Pract. Treatise on this acid*, 2d ed. 1820.

³ Is the formation of cyanogen dependent on the oxidation of gelatine? Persoz states that, when gelatine is submitted to an oxidizing agent, it is susceptible of being transformed into hydrocyanic acid, ammonia, and carbonic acid, and a small quantity of one of the fat, volatile, and odoriferous acids, the existence of which was established by Chevreul (*Brit. and For. Med. Rev.* vol. xii. p. 532).

During the decomposition of animal matters by heat, cyanogen is generated; as when blood and carbonate of potash are calcined in an iron pot. It has also been stated that, when cheese is exposed to the action of water and the sun, it disengages ammonia, and if treated, in this state, by alcohol, yields traces of hydrocyanic acid.

PREPARATION.—The processes for procuring this acid are very numerous. I shall only notice the most important of those which yield the dilute acid employed for medicinal purposes.

a. *By the action of diluted Sulphuric Acid on Ferrocyanide of Potassium.*—This is the process directed by the London, Edinburgh, and Dublin Colleges:—

The *London College* orders of "Ferrocyanide of Potassium \mathfrak{Zij} ; Sulphuric Acid \mathfrak{Zviij} ; Distilled Water Oiss. Mix the acid with four fluidounces of the water, and to these, when cooled and put into a glass retort, add the ferrocyanide of potassium, first dissolved in half a pint of water. Pour eight fluidounces of the water into a cooled receiver; then, having adapted the retort, let six fluidounces of acid, distilled with a gentle heat in a sand-bath, pass into this water. Lastly, add six more fluidounces of distilled water, or as much as may be sufficient, that 12.59 grains of nitrate of silver, dissolved in distilled water, may be accurately saturated by 100 grains of this acid." The resulting product should be twenty ounces.

The *Edinburgh College* orders of "Ferrocyanide of Potassium \mathfrak{Zij} ; Sulphuric Acid $\mathfrak{f\mathfrak{Z}vj}$; Water $\mathfrak{f\mathfrak{Z}xvj}$. Dissolve the salt in eleven fluidounces of the water, and put the solution into a matrass; add the acid, previously diluted with five fluidounces of the water, and allowed to cool; connect the matrass with a proper refrigeratory; distil with a gentle heat, by means of a sand-bath or naked gas flame, till fourteen fluidounces pass over, or till the residuum begins to froth up. Dilute the product with distilled water, till it measures sixteen fluidounces."

[The *Dublin College* directs of "Ferrocyanide of Potassium \mathfrak{Zij} ; Oil of Vitriol of commerce $\mathfrak{f\mathfrak{Z}j}$; and Water \mathfrak{Zxij} . Dissolve the salt in eight ounces of the water, and dilute the oil of vitriol with the remaining four ounces. When both solutions are cold, introduce them successively into a retort or matrass containing several slips of platinum foil, and connected in the usual manner with a Liebig's condenser; and with the aid of a gentle heat let eight ounces be distilled over. Finally, dilute the product with eight ounces of distilled water, or so that the volume of the diluted acid shall be sixteen fluidounces. The specific gravity of this acid is .997."]¹

[The *U. S. Pharm.* directs Ferrocyanide of Potassium \mathfrak{Zij} ; Sulphuric Acid \mathfrak{Ziss} ; Distilled Water a sufficient quantity. Mix the acid with four fluidounces of Distilled Water, and pour the mixture when cool into a glass retort. To this add the Ferrocyanide of Potassium, previously dissolved in ten fluidounces of Distilled Water. Pour eight fluidounces of Distilled Water into a cooled receiver; and having attached this to the retort, distil, by means of a sand-bath, with a moderate heat, six fluidounces. Lastly, add to the product five fluidounces of Distilled Water, or, as much as may be sufficient to render the diluted hydrocyanic acid of such a strength, that 12.7 grains of Nitrate of Silver dissolved in distilled water may be accurately saturated by 100 grains of the acid.

Diluted Hydrocyanic Acid may also be prepared, when wanted for immediate use, in the following manner. Take Cyanuret of Silver fifty grains and a half; Muriatic Acid forty-one grains; Distilled Water a fluidounce. Mix the Muriatic Acid with the Distilled Water, add the Cyanuret of Silver, and shake the whole in a well-stopped phial. When the insoluble matter has subsided, pour off the clear liquor and keep it for use.]

On the large scale, the distillation is conducted in a stoneware still, with a worm refrigerator of the same material. If it be performed in a [tubulated] retort, as directed in the *London Pharmacopœia*, an adopter should be employed. When

¹ [FERROCYANIDE OF POTASSIUM, L. E. D., $\text{K}^2\text{Cfy} + 3\text{HO} = 185.47$.—This salt is one of the articles of *Materia Medica* in the *Pharmacopœias* of the three Colleges. Its use is for the preparation of hydrocyanic acid according to the formulae above given. It crystallizes in quadrangular tables of a bright yellow colour. It loses at 212° , 12.8 per cent. of water, or three equivalents, becoming a white anhydrous salt. At a red heat, it is decomposed into the carburet of iron and cyanide of potassium, and if the incineration take place under a free access of oxygen, the cyanide becomes cyanate of potash. The ferrocyanide of potassium is soluble in four parts of cold, and in two parts of boiling water. It is insoluble in alcohol, and is precipitated in crystalline flakes by this menstruum from its concentrated aqueous solution. Alcohol thus forms a convenient means of separating this salt from the cyanide of potassium (KCy).

This salt is easily procured, and is not subject to adulteration. It is known by the yellow colour of its solution, by its giving, with a persalt of iron (provided the liquid have no alkaline reaction), a rich blue precipitate (Prussian blue); with a salt of copper a deep reddish-brown coloured precipitate, and with a salt of lead a white precipitate. If the powdered crystals of ferrocyanide of potassium be warmed with diluted sulphuric acid, hydrocyanic acid is evolved, known by its odour, and by the tests above mentioned. As this salt is an article of *Materia Medica*, and its description was not given by the author in the section on Potassium and its compounds, in the first volume, we have inserted this short notice of it here. It is now the chief source from which hydrocyanic acid is obtained.—Ed.]

small quantities are to be operated on, we may conveniently employ two Florence flasks (one as the receiver, the other as the distilling vessel), connected by a glass tube curved twice at right angles. The receiver should be kept very cool, ice or snow being used if it can be procured; and the heat employed in distilling should be very moderate. The distilled liquor frequently contains a little sulphuric acid, and, by standing, deposits a small portion of Prussian blue. A second distillation, cautiously conducted, will often separate the sulphuric acid; but I have seen Prussian blue formed and deposited after the hydrocyanic acid has been carefully distilled three times.

The theory of the process, founded on the experiments of the late Mr. Everitt,¹ is as follows: six equivalents or 294 parts of oil of vitriol ($\text{SO}^3 + \text{Aq.}$) react on two equivalents or 426 parts of crystallized ferrocyanide of potassium (composed of four equivalents of cyanide of potassium, two of cyanide of iron, and six of water), and produce three equivalents or 384 parts of the bisulphate of potash, three equivalents or 81 parts of hydrocyanic acid, one equivalent or 174 parts of a new salt (which I shall term the *biferrocyanide of potassium*), and nine equivalents or 81 parts of water. The bisulphate and the new salt remain in the retort, while the hydrocyanic acid with some water distil over. In the London Pharmacopœia an additional quantity of water is employed to assist the condensation of the acid.

MATERIALS.	COMPOSITION.	PRODUCTS.
	3 eq. Water 27	3 eq. Water 27
2 eq. Cryst. Ferrocyanide Potassium 426	3 eq. Water 27 { 3 eq. Hydrogen 3 3 eq. Oxygen 24 3 eq. Cyanide { 3 eq. Cyanogen 78 Potassium 198 { 3 eq. Potass 120	3 eq. Hydrocyanic Acid 81
	1 eq. Cyanide Potassium . . . 66	3 eq. Potash 144
	2 eq. Cyanide Iron 108	
6 eq. Oil of Vitriol 294	6 eq. Water 54	1 eq. Biferrocyanide Potassium . . . 174
	6 eq. Sulphuric Acid 210	6 eq. Water 54
		3 eq. Bisulphate Potash 384
	720	720

The salt here called biferrocyanide of potassium is termed, by the late Mr. Everitt, the *yellow salt*. I have prepared it with the greatest care, but have always found it to be white. Gay-Lussac also says it is white.² By exposure to the air it becomes blue.

β. *By the action of Hydrochloric Acid on Cyanide of Silver.*—This process, proposed by Mr. Everitt, yields an acid of uniform strength, and may be followed when the acid is required for immediate use. The proportions directed by Mr. Everitt are 40 grs. of cyanide, 7 fluidrachms and 20 minims of water, and 40 minims of dilute hydrochloric acid (sp. gr. 1.129). This gentleman says that practitioners could obtain an ounce of the acid, prepared by this process, for one shilling, while the manufacturer could obtain 50 per cent. profit by it.

The *theory* of the process is as follows: by the mutual reaction of one equivalent or 134 parts of cyanide of silver and one equivalent or 37 parts of hydrochloric acid, there are obtained one equivalent or 144 parts of chloride of silver, and one equivalent or 27 parts of hydrocyanic acid.

MATERIALS.	COMPOSITION.	PRODUCTS.
1 eq. Cyanide Silver 134	1 eq. Cyanogen . . . 26 1 eq. Silver 108	1 eq. Hydrocyanic Acid 27
1 eq. Hydrochl. Acid 37	1 eq. Hydrogen . . . 1 1 eq. Chlorine . . . 3	1 eq. Chloride Silver 144
	171	171

Or, $\text{AgCy} + \text{HCl} = \text{HCy} + \text{AgCl}$.

γ. *By the action of Hydrochloric Acid on Bicyanide of Mercury.*—At Apothecaries' Hall, hydrocyanic acid was formerly prepared from one part of bicyanide of

¹ *Lond. and Edinb. Phil. Mag.* Feb. 1835.

² *Ann. Chim. et Phys.* t. xlv. p. 77.

mercury, one part hydrochloric acid (sp. gr. 1.15), and six parts of water. The mixture was distilled until six parts had passed over. The acid thus obtained had a sp. gr. 0.995, and its standard strength was such that two fluidrachms of it dissolved 14 grains of the red oxide of mercury, thereby indicating a strength of about 2.9 per cent. of real acid.

The most convenient method of procuring *concentrated* or *anhydrous* hydrocyanic acid, is by the action of strong liquid by hydrochloric acid on bichyanide of mercury. The vapour should be passed over carbonate of lime, to deprive it of hydrochloric acid; and over chloride of calcium, to remove the water. The receiver should be immersed in a freezing mixture, consisting of ice and chloride of sodium. The theory of the process is as follows: two equivalents or 74 parts of hydrochloric acid react on one equivalent or 254 parts of the bichyanide of mercury, and form one equivalent or 274 parts of the bichloride of mercury, which remain in the retort, and two equivalents or 54 parts of hydrocyanic acid, which distil over ($\text{HCl} + \text{HgCy} = \text{HCy} + \text{HgCl}$).

8. *By the action of Tartaric Acid on Cyanide of Potassium.*—This process was proposed by Dr. Clarke, and adopted by Mr. Laming. The formula of the latter is the following: 22 grains of the cyanide of potassium are to be dissolved in 6 fluidrachms of distilled water, and to this solution are to be added 50 grains of crystallized tartaric acid, dissolved in 3 fluidrachms of rectified spirit. One fluidrachm of the decanted liquor contains one grain of pure hydrocyanic acid.

The objections to this process (which, however, has several advantages) are the trouble and expense of procuring pure cyanide of potassium, and the liability of the salt to undergo spontaneous decomposition.

PROPERTIES. *a. Of Anhydrous Hydrocyanic Acid.*—[The acid may be obtained anhydrous by passing a current of dry sulphuretted hydrogen gas over finely powdered cyanide of mercury contained in a glass tube. The vapour of the acid should be condensed by conducting it into a Liebig's condenser charged with ice-cold water. The decomposition is represented by the following equation, $\text{HgCy} + \text{HS} = \text{HCy} + \text{HgS}$.—ED.] Anhydrous hydrocyanic acid is a solid at 0° F. (some state at 5° F.), having then the appearance of crystallized nitrate of ammonia; it readily melts, forming a limpid colourless liquid, with an intense and peculiar odour; its taste is at first cool, then hot; at 45° its sp. gr. is 0.7058, and at 64½ it is 0.6969. In this state it is exceedingly volatile; a drop placed on paper freezes by its own evaporation. It unites with water and alcohol in every proportion. At 79° or 80° F. it boils, forming hydrocyanic acid vapour, which is combustible; and when mixed with oxygen and ignited, it explodes. Two volumes of the vapour require two and a half volumes of oxygen gas for their complete combustion. The products are two volumes of carbonic acid gas, one volume of nitrogen, and one volume of aqueous vapour, $\text{HCy} + \text{O}^5 = \text{HO} + \text{N} + 2\text{CO}^2$.

Anhydrous hydrocyanic acid undergoes speedy decomposition.¹ Dr. Christison says he has kept it unchanged for a fortnight in ice-cold water. When diluted with water, or mixed with a diluted mineral acid, its tendency to decomposition is diminished.

β. *Of diluted Hydrocyanic Acid.*—Diluted or medicinal hydrocyanic acid is a colourless, transparent liquid, having the taste and smell of the strong acid, but in a lesser degree. Heated in a tube it gives off a combustible vapour.

COMPOSITION.—The ultimate constituents of pure hydrocyanic acid are Carbon, Nitrogen, and Hydrogen.

Atoms.	Eq. Wt.	Theory.	Gay-Lussac.		Vols.
Carbon	2	12	44.4	44.45	Carbon vapour 1 or 2
Nitrogen	1	14	51.9	51.85	Nitrogen gas 1
Hydrogen	1	1	3.7	3.70	Hydrogen gas 1
Hydrocyanic Acid	1	27	100.0	100.00	Hydrocyanic Vapour 2

¹ [The change which ensues under the influence of light appears to be the formation of a brownish-black substance (not examined) and sesquicarbonate of ammonia. A small quantity of a mineral acid, diluted, is well known to prevent the change; but a concentrated mineral acid rapidly converts hydrocyanic acid into ammonia and formic acid, if the elements of water be present: $\text{HCy} + 3\text{HO} = \text{NH}^2 + \text{C}^2\text{H} + \text{O}^2$.—ED.]

But it is more usual to regard this acid as a compound of hydrogen and cyanogen, the latter substance being a bicarburet of nitrogen. On this view the composition will be as follows: C^2N_2H or CyH .

Atoms.	Eq. Wt.	Per Cent.		Vols.
Cyanogen 1	26	96.3	Cyanogen gas 1	
Hydrogen 1	1	3.7	Hydrogen gas 1	
Hydrocyanic Acid . . 1	27	100.0	Hydrocyanic Vapour . . 2	

STRENGTH OF THE DILUTED ACID.—In the London Pharmacopœia, hydrocyanic acid is directed to be prepared of such a strength that 100 grains of it will exactly precipitate 12.59 grains of nitrate of silver dissolved in water: the precipitate, which is cyanide of silver, should weigh when quite dry 10 grains. Five parts of this precipitate correspond to one of real acid. Hence the diluted acid *Ph. L.* consists of—

Real hydrocyanic acid	2.0
Water	98.0
Diluted Hydrocyanic Acid (<i>Ph. L.</i>)	100.0

The Acidum Hydrocyanicum *Ph. Ed.* consists of “Hydrocyanic Acid diluted with about thirty parts of water.” Hence its percentage composition is as follows:—

Real hydrocyanic acid	3.226
Water	96.774
Acidum Hydrocyanicum (<i>Ph. Ed.</i>)	100.000

[This preparation has nearly twice the strength of the London acid. According to Mr. Squire, 100 minims, or 91 grains, should entirely precipitate 22 grains of nitrate of silver: it has therefore nearly a strength of 3.98 per cent. Dr. Christison assigns 3.3 per cent. as its ordinary strength.—*Ed.*]

The Edinburgh College gives the following directions for ascertaining the strength of the acid:—

“Fifty minims [of the acid] diluted with one fluidounce of distilled water, agitated with 390 minims of solution of Nitrate of Silver [*Ph. Ed.*], and allowed to settle, will again give a precipitate with 40 minims more of the test; but a farther addition of the test, after agitation and rest, has no effect. The precipitate entirely disappears in boiling nitric acid.”

[The Acidum Hydrocyanicum Dilutum *Ph. Dub.*, as now made, contains, according to Mr. Squire, rather more than 2 per cent. of real acid.¹ The strength of the acid has not been fixed by this College.—*Ed.*]

This discrepancy in the strength of the acid ordered in the British Pharmacopœias is greatly to be regretted. Most of the acid met with in the shops of London chemists is stated by the label to be of “Scheele’s strength.” But as Scheele’s process² gave an acid of variable strength, this statement is by no means definite. A manufacturer of large quantities of the acid informs me he sells, under the name of Scheele’s acid, a diluted hydrocyanic acid, which contains 4 per cent. real acid.

PURITY.—Diluted hydrocyanic acid should be perfectly colourless. Decomposed acid is frequently, but not invariably, coloured. It should be vapourizable by heat; this character shows the absence of fixed impurities. The presence of metallic matter is recognized by hydrosulphuric acid, which has no effect on the pure acid. If the acid strongly reddens litmus, it must contain some other acid, most probably the sulphuric or hydrochloric. The presence of any foreign acid is easily determined by the *hydrargyro-iodocyanide of potassium*. This salt is formed by adding a concentrated solution of bityanide of mercury to a solution of iodide of potassium; a precipitate of white or pearly crystalline plates of the salt is immediately pro-

¹ *Dublin Pharmacopœia*, 1850.

² Scheele prepared this acid by boiling together Prussian blue, peroxide of mercury, and water. Bityanide of mercury was obtained in solution. Iron filings and sulphuric acid were then added, and the products of the reaction were hydrocyanic acid, metallic mercury, and sulphate of iron. The liquor was then submitted to distillation.—The strength of the acid product varied with the degree of purity of the Prussian blue.

duced. If a small portion of the crystals be placed in diluted hydrocyanic acid, no change is observed unless some foreign acid be present; in the latter event, the red biniodide of mercury immediately makes its appearance. For this test we are indebted to Dr. Geoghegan.¹ Sulphuric acid may be detected by a solution of the salts of barium. "Solution of nitrate of baryta occasions no precipitate" in the pure acid (*Ph. Ed.*); but if sulphuric acid be present, it occasions a white precipitate (*sulphate of baryta*), insoluble in nitric acid. Hydrochloric acid is recognized by nitrate of silver, which forms therewith white chloride of silver insoluble in boiling nitric acid, whereas the white cyanide of silver is soluble in nitric acid at a boiling temperature. I would observe that the presence of either of these acids is no further objectionable than that it creates a difficulty in the determination of the strength of the hydrocyanic acid; while, on the other hand, it confers the advantage of rendering the hydrocyanic acid much less liable to decomposition. The acid prepared from ferrocyanide of potassium will keep for years (Dr. Christison has had some unchanged for two years and a half, though it was exposed to daylight), owing, it is supposed, to the presence of some sulphuric acid. Mr. Barry adds a little hydrochloric acid to all his medicinal hydrocyanic acid, in order to preserve it. As air and light hasten, though they are not essential to, the decomposition of the acid, they should be carefully excluded.

CHARACTERISTICS.—The following are the best tests for hydrocyanic acid:—

1. *The odour.*—The peculiar odour of hydrocyanic acid is well known. It must not be confounded with the odour of the volatile oil of bitter almonds. Orfila says that this is the most delicate characteristic of the acid, since it is very marked when the liquid tests give very slight indications only. But I have not found this to be invariably the case; it depends much on the nature of the mixture containing the acid.

2. *Formation of Prussian blue (Ferrosesquecyanide of iron).*—Add sufficient caustic potash to the suspected acid to saturate it; then a solution of some proto- and sesqui-salt of iron; the common sulphate of iron of the shops, or the tincture of the chloride, answers very well, since both these preparations usually contain the two (*proto-* and *sesqui-*) salts of iron. A precipitate is thus obtained, which is liable to considerable variation in its colour, depending on the quantity of potash or of the ferruginous salt employed; it may be yellowish brown, or greenish, or bluish. Then add dilute sulphuric or hydrochloric acid, when Prussian blue (*ferrosesquecyanide of iron*) will immediately make its appearance, if hydrocyanic acid were present.

The formation of Prussian blue is thus accounted for. When potash is added to hydrocyanic acid, water and cyanide of potassium are generated. By the reaction of this salt on a proto-salt of iron the proto-cyanide of iron is produced, while with a sesqui-salt of iron it forms sesquecyanide of iron. The two ferruginous cyanides, by their union, constitute the ferrosesquecyanide or Prussian blue. The acid added removes the surplus oxide of iron.

[This test will detect hydrocyanic acid when it is mixed with common salt or other chlorides which interfere with the reaction of nitrate of silver. It is on the whole a delicate test when properly employed; but a frequent cause of failure in its application is the addition of too much potash, or of the iron salt. The Prussian blue formed is decomposed by an excess of potash; and if the quantity of iron be too large, the liquid, when the surplus oxide of iron is dissolved by an acid, will acquire a yellow colour, and give a greenish tint to a small quantity of Prussian blue formed at the expense of the hydrocyanic acid. This experiment may be performed in a white saucer. Put a drop of solution of potash in the centre of the saucer, and invert it over another saucer of the same size containing the hydrocyanic acid. After two or three minutes (or five minutes if the acid be much diluted), remove the upper saucer, and drop on the potash one drop of a solution of

¹ *Dublin Journal*, Nov. 1835.

green sulphate of iron. Agitate and expose to the air for a few seconds. Add one or two drops of diluted sulphuric acid to dissolve the surplus oxide of iron, and if prussic acid was present, a slight trace of Prussian blue will remain in the liquid.—Ed.]

3. *Nitrate of Silver*.—This is a delicate test of the presence of hydrocyanic acid. It causes a white precipitate of cyanide of silver, which is soluble in *boiling* concentrated nitric acid. By this latter character cyanide is distinguished from chloride of silver. If carefully dried cyanide of silver be heated in a small glass tube, it evolves cyanogen gas, known by its combustibility and the colour (violet or bluish-red) of its flame.

[A watch-glass moistened with nitrate of silver, and inverted over a vessel containing hydrocyanic acid, will enable us to detect the presence of a very minute quantity of the acid. The spot of nitrate of silver becomes speedily opaque and white, from the production of cyanide by the action of the vapour of the acid.

4. *The Sulphur Test*.—A few years since Liebig made the discovery that a mixture of hydrocyanic acid and hydrosulphate of ammonia, when warmed, underwent decomposition, and sulphocyanate of ammonia resulted. The application of a per-salt of iron, by producing a deep blood-red colour in a liquid containing even a minute trace of sulphocyanate, thus enables us to detect the presence of prussic acid indirectly.

When hydrocyanic acid is procured in a free state as a liquid, the Prussian blue and silver tests are sufficient to determine its presence unequivocally; but when the acid is in small quantity, and mixed with solids or fluids partially decomposed, then a modification of this test will enable us to detect a quantity of the poison which, from its minuteness, and from the absence of the usual odour, might otherwise escape notice.

Place the solid or liquid, suspected to contain the poison, in a glass vessel, to the top of which a large watch-glass can be pretty accurately adjusted. The poisoned liquid or solid should fill the glass vessel to within half an inch of the top. If the quantity be small, then another watch-glass, of equal size to that taken, may be employed.

Place two drops of a solution of hydrosulphate of ammonia, containing an excess of sulphur, in the centre of the upper glass, and inverted accurately over the vessel containing the poisoned liquid. In three or four minutes the upper glass may be removed, and the moistened spot gently dried over a spirit-lamp or on a sand-bath. A white film is left when the quantity of acid is small; this may be a film of sulphur resulting from the evaporation of the hydrosulphate of ammonia, or a film of sulphocyanate of ammonia formed by a reaction of the vapour of hydrocyanic acid on the hydrosulphate. In the latter case the film has frequently a crystalline character. The film may be moistened with a drop of water, and a drop of persulphate or perchloride of iron allowed to fall on it. If prussic acid was present in the suspected solid or liquid, a blood-red coloured liquid appears (sulphocyanate of iron), and this red colour is discharged by the addition of one or two drops of a solution of corrosive sublimate.

If there were no prussic acid present, the film will be sulphur, and the solution of per-salt of iron will produce no effect. If any undecomposed hydrosulphate remain on the glass (a fact generally known by the liquid having a yellow colour), then the per-salt of iron will produce a black precipitate (sulphuret of iron). In this case the evaporation has not been carried far enough.

Except in liquids or solids which have undergone decomposition, and from which sulphuretted hydrogen is evolved, the nitrate of silver, applied as already described above, to receive and absorb the vapour, may be usefully employed as a preliminary or trial test.

[The sulphur test, as applied to the vapour of hydrocyanic acid, is the most delicate test for this poison which has been hitherto discovered.—Ed.]

DETECTION OF THIS ACID IN CASES OF POISONING.—As hydrocyanic acid is a

substance which readily undergoes decomposition, it is not likely to be met with in bodies which have been interred for many days. It has, however, been recognized in one case seven days after death, notwithstanding that the trunk had not been buried, but had been lying in a drain;¹ and in other cases for still longer periods. In recent cases the acid is readily distinguished by its odour, with which, in some instances, the whole body is impregnated. The liquid tests for this acid, already mentioned, will sometimes detect the poison in the filtered contents of the stomach; but the foreign matters present may, occasionally, prevent their characteristic action. The best mode of proceeding in that case, is, to introduce them into a tubulated retort, to add some sulphuric acid to neutralize any ammonia which might be generated by the process of putrefaction, and to distil to one-half by means of a vapour or water-bath; then apply the tests already mentioned to the distilled liquid. The addition of sulphuric acid is not necessary unless the liquid be strongly alkaline.

It has been suggested that hydrocyanic acid may be formed during the process of distillation by the decomposition of animal matters; but, as Dr. Christison has justly observed, the objection appears only to rest on conjecture, or presumption at farthest. [Farther, the objection is untenable when the poison can be detected by its vapour prior to distillation.—ED.] It is to be recollected that unsound cheese has, under certain circumstances, been found to contain this acid, as already mentioned. It is not improbable that it may be found in many animal substances during their spontaneous decomposition. It is said to have been detected in ergot of rye.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Hydrocyanic acid is a poison to plants. The stamina of *Berberis vulgaris*, and the leaves of *Mimosa pudica*, lose their irritability when the stems bearing them are immersed in the diluted acid.² Seeds lose the power of germination by immersion in this acid. In those parts of latescent plants which are poisoned by it, the milky juice does not flow from the cells or vessels in which it is contained. By chemical means it has been shown that the acid becomes absorbed.³ Ammonia has, in some cases, appeared to favour the recovery of plants which had been exposed to the vapour of the acid.⁴

β. On Animals generally.—Hydrocyanic acid is an energetic poison to animals. Experiments have been made with it on the following: *Mammalia, Aves, Reptilia, Amphibia, Pisces, Gasteropoda, Annelida, Crustacea, Insecta, and Infusoria.*⁵ The general effects are very similar on all classes, and consist essentially of loss of sensation and voluntary motion, with convulsive movements. Mr. Gray, however, states that some of the larvæ of the common *Musca* having been put into hydrocyanic acid, remained uninjured after two or three days' exposure.⁶ The cold-blooded animals are more slowly affected by hydrocyanic acid than the hot-blooded ones. Dr. Christison states that 25 grs. of the strong acid, applied to the mouth, killed a rabbit within ten seconds. I once caused the almost instantaneous death of a rabbit by applying its nose to a receiver filled with the vapour of the pure acid; the animal died without the least struggle. If a drop of the pure acid be placed on the throat of a dog, or applied to the eye, death takes place in a few seconds. Inhaling the vapour decidedly produces death more quickly than any other mode of using the acid. If the pure acid be applied to the eye of a dog, it causes opacity and whiteness of the cornea, and a copious flow of tears. In a very short time it gives rise to constitutional symptoms.

γ. On Man. aa. In small or medicinal doses.—Small doses of hydrocyanic acid sometimes relieve certain morbid conditions (as of the stomach), without producing any remarkable alteration in the condition of the general system. If the dose be cautiously increased, and its operation carefully watched, the following effects are

¹ Chevallier, *Ann. d'Hygiène Publiq.* ix. 337.

² De Camille, *Physiol. Végét.* p. 1357.

³ Caillon, quoted by Wibmer, *Wirkung d. Arzneim.* 3 Bd. p. 1:0.

⁴ *Athenæum* for 1837, p. 671.

⁵ Macaire, *Biblioth. Universelle*, xxxi. 244.

⁶ Macaire, *op cit.*

usually observed: a bitter but peculiar taste; increased secretion of saliva; irritation in the throat; frequently nausea; disordered and laborious respiration (sometimes quick, at others slow and deep); pain in the head, giddiness, obscured vision, and sleepiness. The vascular system is in some cases not obviously, but in others much, affected, though not uniformly; its action being sometimes quickened, at others reduced in frequency. In some instances faintness is experienced. Drs. Macleod and Granville¹ have noticed salivation and ulceration of the mouth during its medicinal use.

ββ. *In poisonous doses: convulsions and insensibility (epilepsy?)*: if death occur, it takes place slowly.—Immediately after swallowing the acid, a remarkably bitter taste, sometimes described as hot, is experienced; this is soon followed by a sensation of faintness and giddiness, with salivation, and is succeeded by tetanic convulsions and insensibility; the respiration is difficult and spasmodic; the odour of hydrocyanic acid may be recognized in the breath; the pupils are usually dilated, though sometimes contracted; the pulse is small or imperceptible. When recovery takes place it is usually very rapid, and the whole period of suffering seldom exceeds half an hour. However, exceptions to this exist, in which the symptoms have been prolonged for several hours.

The following case, related by Dr. Geoghegan,² is an interesting illustration of these effects: A gentleman, aged 21, having been for some time subject to an uneasiness in the stomach, not actually amounting to gastrodynia, after having tried many remedies in vain, was induced to have recourse to hydrocyanic acid. He commenced with one minim of the Dublin Pharmacopœia, sp. gr. 0.998; this dose he repeated twelve times the first day, without any perceptible effect. On the following day he took half a drachm, with the same result. The third day his dose was a drachm, which he repeated the fourth day. On the fifth day he took a drachm and a half; still, no effect of any kind. On the sixth day he increased his dose to two drachms. In about two minutes after taking this quantity, he experienced a sensation of extreme bitterness in the mouth, and having walked a few paces, was affected with great confusion, headache, and loud ringing in his ears. He now with difficulty retraced his steps, and leaning forward on a table, became insensible and fell backwards. In this state he remained altogether between three and four minutes, during which time he was violently convulsed. Two drachms of the spiritus ammoniæ aromaticus were diluted with a little water, and applied as quickly as possible to the mouth, but as the teeth were clenched it could not be swallowed. The solid sesquicarbonate of ammonia was then applied assiduously to the nostrils; its beneficial effects were soon apparent, and he was shortly able to swallow a little fluid. Sensibility now speedily returned, and vomiting supervened, from which he experienced great relief; and at the expiration of half an hour he was quite well, with the exception of pain and a feeling of distension in the head, which continued for the remainder of the day. After he had become insensible, and while leaning on the table, his thighs became rigid, and were drawn up on the abdomen; and as he was about falling, he was caught and placed on the ground. The upper extremities were then observed to be also rigid, and on drawing them from the side they forcibly reverted to their former position; the eyes were shut, the teeth clenched, and the muscles of the face violently convulsed. It is deserving of notice that the old complaint was completely removed by this extraordinary dose.

γγ. *In poisonous doses: death rapid with or without convulsions.*—In these cases death is so rapid that, in the human subject, the symptoms have scarcely been observed. They are probably similar to those noticed in animals, viz. imperceptible pulse, breathing not obvious; or there may be two or three deep, hurried inspirations, insensibility, and death. Convulsions may or may not be present.

The presence or absence of convulsions, as connected with the time within which death occurs in these cases, is sometimes a matter of great moment. Some years ago the life of a prisoner almost turned on this point. The following is an outline of the case.³ An apothecary's maid-servant, at Leicester, was found one morning dead in bed. The body lay in a composed posture—the arms crossed over the trunk, and the bedclothes pulled smoothly up to the chin. At her right side lay a phial, from which about five drachms of the medicinal hydrocyanic acid had been taken, and which was corked and wrapped in paper. It was suspected that she took the acid to occasion miscarriage, and that the apprentice was accessory to its administration; in consequence of which he was put on his trial. The important question for the con-

¹ *Lond. Med. and Phys. Journ.* vol. xlv. pp. 359 and 363.

² *Dublin Med. Journ.* Nov. 1835.

³ More fully developed in Dr. Christison's *Treatise on Poisons*, and in the *Medical Gazette*, vol. viii. pp. 577 and 797.

sideration of the medical witnesses was : Could the deceased, after having drunk the poison, have had time to cork the phial, wrap it up, and adjust the bedclothes, before insensibility came on? It was supposed that if the death were of that slow description to allow of these acts of volition, convulsions would have occurred, and the bedclothes would have been found disordered. On the other hand, those cases in which no convulsions occur, usually terminate too quickly to allow of the above acts. The medical witnesses in the above case were not agreed in opinion; the majority thought it was impossible that the deceased could have had the power of corking the bottle. The jury, however, very properly found the prisoner not guilty.

There are two points of inquiry connected with the action of this acid, which are interesting, more particularly in a medico-legal point of view—namely, the time at which the poison begins to operate, and the period in which it proves fatal. No absolute answer can be given to either of these questions, since the strength and quantity of the acid exhibited, and peculiarities (not known or understood) affect the result. Very strong acid, in large doses, begins to operate very speedily, especially if its vapour be inhaled. The diluted acid, on the other hand, sometimes does not produce any obvious effect for several minutes, and death may not occur for nearly half an hour. Of seven epileptic patients killed in one of the Parisian hospitals by hydrocyanic acid, some did not die for forty-five minutes.³ But I have not found the same quantity of the same acid kill different animals of the same species in the same period of time.

MORBID APPEARANCES.—The *post-mortem* appearances in cases of poisoning by this acid are the following: Glistening and staring expression of the eyes, but which, however, is not a constant phenomenon, since it was not observed in the seven Parisian epileptics; nor is it peculiar to this poison, for the same is observed after death by carbonic acid, and in other cases (Christison); the odour of the acid is oftentimes very obvious in the blood, brain, chest, or stomach; the venous system is usually gorged with blood, while the arteries are empty; the blood is, in many cases, fluid, dark, or bluish-black, and viscid or oily; the vessels of the brain and spinal marrow are frequently gorged with blood; and the cerebral ventricles sometimes contain a serous or sanguineous liquor; the lungs are, in some instances, natural—in others, turgid with blood; the internal lining of the stomach is sometimes red.

It has been stated by Magendie, that, after death by the strong acid, the muscles are not sensible to the galvanic influence. But this condition is very rarely present; indeed, I have never observed it in animals killed by this acid; though Dr. Christison has occasionally found it. I have examined a considerable number of animals (principally rabbits) destroyed by hydrocyanic acid, and have always found the muscles to be powerfully affected by the galvanic influence; nor have I once met with a single case in which the heart had ceased to beat when the chest had been laid open immediately after death.

MODUS OPERANDI.—There are several interesting subjects of inquiry connected with the operation of hydrocyanic acid, which, as they are principally theoretical, I shall briefly notice under this head.

a. Local action.—Dr. Christison says that Robiquet's fingers became affected with numbness, which lasted several days, in consequence of their exposure for some time to the vapour of this acid.² This effect would appear to depend on the local action of the poison on the nerves—a mode of operation which we are constrained likewise to admit in the case of some other narcotics.³ The alleviation of gastrodynia by hydrocyanic acid depends probably on this benumbing effect. Some of the local effects produced by hydrocyanic acid are those of an irritant; such are the acrid impression made by the vapour on the nose and mouth, the ptyalism, the vomiting and purging, and the redness of the mucous membrane of the stomach.

β. Absorption.—That hydrocyanic acid becomes absorbed is proved by its having been detected by Krimer (quoted by Dr. Christison, p. 15) in the blood of animals poisoned with it, and by the odour of it exhaled from various parts of the body.

¹ *Annales d'Hygiène Publ. et de Méd. Leg.* t. ii.

² *Treatise on Poisons*, 3d edit. p. 698.

³ *Möller's Physiology*, by Baly, vol. i. p. 630.

The exhalation by the breath of the odour of the acid may sometimes enable us to recognize the presence of the poison in the system.¹

γ. *Are the remote effects of this acid caused by its absorption?*—In many cases the operation of hydrocyanic acid on the system is so rapid, and death so speedily follows the application of the poison, that doubt has been entertained of its action being dependent on its absorption. The principal arguments which have been adduced in favour of the agency of absorption are the following: *First*, that the acid produces no remote effects when applied either to the nerves or brain; *secondly*, that applied to the tongue or stomach it operates as an energetic poison, although the nerves of these parts were previously divided; *thirdly*, that if the acid be applied to a part where circulation is arrested, the operation of the poison is prevented; *fourthly*, the activity of the acid is in proportion to the absorbing powers of the part with which it is placed in contact; *fifthly*, a sufficient time always elapses between its application to the body and the first symptom of its action, to admit of its operation by absorption.

δ. *Organs affected.*—The parts specifically affected by this acid are the brain and true spinal system. The pain in the head, the insensibility, and the coma, are evidence of the cerebral affection; while the tetanic convulsions depend on the disorder of the true spinal system. Marx² mentions the following experiment performed by Wedemeyer,³ and which shows the independent action of the acid on the spinal marrow: The spinal cord of a dog was divided between the last dorsal and first lumbar vertebrae, so that the hind legs were completely paralyzed and insensible to mechanical irritants; hydrocyanic acid was then introduced into one of the hind legs; in one minute symptoms of poisoning commenced; the hind as well as the fore legs were violently convulsed, and in twelve minutes the animal was dead. The affection of the respiratory and circulatory system produced by hydrocyanic acid is probably only secondary; that is, the result of the influence of this agent over those parts of the nervous system from which the respiratory organs and heart derive their nervous power. The insensibility caused by hydrocyanic acid occurs too rapidly, in many cases, to be the result of asphyxia caused by paralysis of the muscles of respiration.

ε. *Condition of the brain and spinal marrow induced by this acid.*—The precise pathological condition of the brain and spinal cord of an animal under the influence of hydrocyanic acid, cannot be positively determined, and it is, therefore, a matter of conjecture. Whatever it may be, it is probably identical with that which occurs during an epileptic paroxysm, and with that produced by loss of blood; for the essential symptoms (insensibility and convulsions occurring suddenly) are the same in all three states—and ammonia has been found to relieve them. Dr. Marshall Hall⁴ has shown that the convulsions from hemorrhage are spinal. Dr. Holst, Professor of Materia Medica in the University of Christiania, Norway, told me of a case of epilepsy which had been under his care, and in which it was observed that the pulse in one arm was always imperceptible during the paroxysm. On a *post-mortem* examination, it was discovered that an anomalous distribution of the arteries existed, so that this arm was supplied with blood by the vertebral arteries, which derived it, through the basilar artery, from the carotids. The cessation of the pulse during the paroxysm proved that the circulation through these vessels was temporarily interrupted. Does any similar interruption occur in poisoning by hydrocyanic acid?

ζ. *Cause of death.*—In most cases the immediate cause of death is obstruction of respiration. In some instances it is stoppage of the heart's action. There are cases, however, in which the death is too immediate to be produced by obstructed respiration, while, on opening the chest, the heart is found still beating; this I have observed in experiments on rabbits with strong hydrocyanic acid.

¹ Dr. Lonsdale, in the *Edinb. Med. and Surg. Journ.* for Jan. 1839.

² *Die Lehre von d. Giften*, 1er Bd. 2te Abt. S. 154. ³ *Versuche über das Nervensystem*, S. 241. Vers. 7.

⁴ *Lect. on the Nerv. Syst.* p. 139.

7. *Cumulative effects.*—Hydrocyanic acid is not usually regarded as a cumulative poison; but a case mentioned by Dr. Baumgärtner (quoted by Dr. Christison), as well as some other circumstances, seem to favour the reverse opinion.¹

USES.—We are indebted to the Italians (Borda, Brugnatelli, and Rasori), for the introduction of hydrocyanic acid into the *Materia Medica*. It was first employed by them at the commencement of the present century; namely, from 1801 to 1806.²

a. *Internal.*—By the founders of the theory of contrastimulus, this acid was regarded as a powerful asthenic or contrastimulant, and, therefore, as peculiarly useful in all diseases dependent on, or connected with, excitement. Hence it was employed in inflammatory affections. But subsequent experience has fully shown that in these cases it possesses little or no remedial power. In this country, the reputation of hydrocyanic acid as a medicinal agent is chiefly founded on its effects in alleviating certain painful (neuralgic) and spasmodic stomach complaints. It appears from Dr. Granville's statements,³ that laurel water (which contains this acid) was used in these affections by Hufeland, Haller, Thuessen, Swediaur, and Sprengel, between the years 1780 and 1796. But the first person who actually recommends hydrocyanic acid for them is Sprengel,⁴ in 1814. In 1819, Dr. A. T. Thomson detailed a case which led him to infer that this acid would be an important agent in the treatment of dyspeptic affections. But the profession are principally indebted to Dr. Elliotson⁵ for a full investigation of its powers in these complaints.

Every practitioner is familiar with a stomach complaint in which pain of a spasmodic character is the leading symptom, but which is not essentially accompanied by pyrexia, as in gastritis—by tendency to faint, as in cardialgia—by indigestion, as in dyspepsia, nor by loss of appetite; though one or more of these conditions may attend it. By some nosologists (as Sauvages and Sagar) it has been regarded as a distinct disease, and has been termed *gastrodynia*. It is not unfrequently accompanied by vomiting and præcordial tenderness, which, however, cannot be regarded as indicative of inflammation, for various reasons; one of which is the alleviation of it often obtained by the use of stimulants and antispasmodics. What may be the precise pathological condition of this malady I know not. Dr. Barlow⁶ thinks the primary disease to be irritation or excitement of the mucous membrane of the stomach, whereby a redundant, dense, membranous, and opaque mucus is secreted, which accumulates and oppresses the stomach. The pain he supposes to arise from a contractile effort of the stomach to detach and expel the offending matter; but the immediate and permanent relief sometimes obtained by the use of hydrocyanic acid is, I conceive, almost fatal to this hypothesis. Some time since, I prescribed the acid for a lady who had suffered for months with *gastrodynia*, and who was persuaded, from her sensations, that she had some organic disease. The remedy acted in the most surprising manner; in a few hours, to the astonishment of herself and friends, she was apparently quite well, and has since had no return of her complaint. It can hardly be imagined that irritation of stomach can be rapidly removed by a substance which is itself an irritant. For my own part, I conceive the affection to be, essentially, a disordered condition of the nerves supplying the stomach, or of the nervous centres from whence those nerves are derived; in other words, it is a gastric neuralgia. It is frequently, but not invariably, accompanied by the irritation of stomach alluded to by Dr. Barlow. But be the proximate cause of the disease what it may, the beneficial effects of the hydrocyanic acid, in some instances of it, are most astonishing; while in others it totally fails. In all the cases in which I have tried it, I have obtained either perfect success or complete failure; I have met with no cases of partial relief. It not only

¹ See Dr. Christison's *Treatise*.

² *Op. cit.*

³ Granville, *Treatise on Hydrocyanic Acid*, 2d edit. 1820.

⁴ *Pharmacologia*.

⁵ Numerous Cases illustrative of the Efficacy of the Hydrocyanic Acid in Affections of the Stomach, 1820.

⁶ *Cyclopædia of Practical Medicine*, art. *Gastrodynia*.

allays pain, but relieves vomiting; and in the latter cases, frequently, when all other remedies fail. Dr. Elliotson mentions the following as the stomach affections relieved by it: 1st, those in which pain at the stomach was the leading symptom; 2dly, those in which the gastrodynia was accompanied by a discharge of fluid, constituting what is called pyrosis, or the water-brash; 3dly, when the excessive irritability of the stomach produces vomiting; and 4thly, those disorders of the stomach which, in some of their symptoms, resemble affections of the heart. The late Dr. Prout found it useful in gastrodynia connected with colica pictorum.

I have also found it useful in a painful affection of the bowels analogous to that of the stomach, and which, therefore, might with propriety be termed *enterodynia*. The most remarkable case of this kind which I have met with was that of a gentleman, a relative of one of my pupils. He had suffered, for several months, excruciating pain in the bowels, commencing daily about two o'clock, and only ceasing at night. It was apparently a consequence of an ague. He had been under the care of several country practitioners, and had tried a number of remedies (including opium and disulphate of quinia) without the least benefit. I advised the employment of the hydrocyanic acid, and accordingly five minimis were administered at the commencement of a paroxysm. The remedy acted like a charm; all the unpleasant symptoms immediately disappeared. Several doses of the acid were given before the period of the succeeding paroxysm, but the disease never returned; and after employing the acid for a few days longer, he went back to the country completely cured.

I have seen hydrocyanic acid used with great success to allay vomiting and purging in severe forms of the ordinary English cholera, when opium has completely failed. In Asiatic or malignant cholera it has occasionally appeared to be serviceable. I have found it successful in checking the diarrhœa of phthisical subjects, when logwood, chalk, and opium had failed. As a remedy for affections of the pulmonary organs, hydrocyanic acid was at one time in great repute. It was said to be capable of curing slight inflammation of the lungs, without the necessity of bloodletting; of suspending or curing incipient phthisis, while in confirmed cases it smoothed the approach of death; of curing hooping-cough, and of removing all the symptoms of spasmodic asthma.¹ Experience has shown the fallacy of most of these statements. I have employed hydrocyanic acid in a considerable number of cases of phthisis, and have occasionally fancied that it relieved the cough and night-sweats; but these effects were only temporary. Cases of genuine spasmodic asthma are rare; but in two instances in which I have seen the acid employed no relief was obtained. In allaying cough (especially the kind called spasmodic) I have, on several occasions, found it useful; but it has so frequently disappointed my expectations, that I now rarely employ it in any pulmonary diseases. I have never observed any ill effects from its use in these cases, though others assert they have. Dr. Roe² ascribes to this acid the power of curing simple hooping-cough; that is, convulsive cough unaccompanied by inflammatory symptoms. He gives it in conjunction with ipecacuanha and tartarized antimony. In two or three days after the use of these remedies, the violence of the paroxysms, he says, is perceptibly diminished, and their duration shortened. To a girl of ten years of age he gave a minim and a half of the acid every quarter of an hour, for twelve hours. I have not found this practice so successful as Dr. Roe's reports would lead us to expect.

This acid has been employed in affections of the nervous system. Cases of hysteria, epilepsy, chorea, and tetanus, have been published, in which this remedy has been found beneficial. I have seen it employed in the first three of these affections, but without any evident relief. It has been repeatedly used in hydrophobia, at the London Hospital, but without success. A most interesting case of its employment in this malady has been published in the *Lancet* (for May 10, 1839). Under

¹ See Dr. Granville's *Treatise*, before referred to; and also Magendie's *Recherches sur l'Emploi de l'Acide Prussique*, 1819.

² *A Treatise on the Nature and Treatment of Hooping-Cough*, Lond. 1838.

its use the hydrophobic symptoms subsided, and typhus fever supervened, of which the patient, after some days, died. Dr. Hall¹ proposes that, in addition to the use of this acid, tracheotomy, as suggested by Mr. Mayo, should be tried. Hydrocyanic acid has been administered as an *anodyne* in several painful affections; namely, cancer, *tie douloureux*, rheumatism, &c.; but, with a few exceptions, it has not been found serviceable. As an *anthelmintic* it has been extolled by Brera; but the following fact, mentioned by Dr. Elliotson, will, I imagine, show its true value: "I have frequently employed it perseveringly without expelling one worm, when a dose of calomel has instantly brought away hundreds."

3. *External*.—The local employment of the acid has not been attended with very great success. In chronic skin diseases, especially impetigo, prurigo, and psoriasis, the acid has been recommended by Dr. A. T. Thomson to allay pain and irritation. Schneider, of Dusseldorf, has employed one drachm and a half of hydrocyanic acid, six ounces of spirit, and as much rose water, in scaly diseases attended with severe itching, especially in eruptions upon the genital organs. On several occasions I have tried hydrocyanic washes in prurigo, but without obtaining any relief. Dr. Elliotson says he has found it efficacious in sores behind the ears, and in scabs of the face; and adds, to an irritable face it is very soothing, if employed before and after shaving. In cancer of the uterus, lotions containing this acid have been employed to allay the pain, by Frisch, of Nyborg. Osiander has also employed, in the same disease, cherry-laurel water, the active principle of which is this acid. In gonorrhœa, injections containing hydrocyanic acid have been employed with benefit. Schlegel has tried also the cherry-laurel water with the same result. Lastly, the diluted acid has been proposed as an effectual mode of destroying vermin.

ADMINISTRATION.—The best mode of exhibiting this acid internally is in the form of mixture. I generally give from three to five minims of the diluted acid, *Ph. L.*, three or four times a day, in about an ounce of some mild vehicle (simple water answers very well). Gum or syrup, and some flavouring ingredients (as orange-flower water, which is used on the continent), may be added. Some persons give it in almond emulsion. In some cases of irritable stomach this is objectionable.

As a wash, two fluidrachms of the diluted acid of the shops may be employed, mixed with half a pint of distilled (or rose) water, as a lotion, in skin diseases. Frequently, about half an ounce of rectified spirit is added; and Dr. A. T. Thomson recommends, in addition to this, sixteen grains of acetate of lead. The external use of this acid, in all cases (more especially if there be sores) requires great caution. Its effects on the nervous system and on the pulse must be carefully watched. In some cases it causes giddiness and faintness; and Mr. Plumbe says, in two instances it produced intermission of the pulse.

[DOSE.—This necessarily varies with the kind of acid employed. The dose of the acid of the London College may be taken at from two to seven minims; of the Edinburgh College, from one to four minims; and of the Dublin College, from one to five minims. The dose of the *Acidum Hydrocyanicum Dilutum*, U.S., is one to six drops. The smallest dose should be commenced with always, and the maximum dose exhibited only in those cases where tolerance exists.—ED.]

ANTIDOTES.—The most important agents in the treatment of poisoning by hydrocyanic acid, as well as by the substances which contain it (*viz.* the cherry-laurel, bitter almonds, the volatile oil of these substances, &c.), are *chlorine*, *ammonia*, *cold affusion*, and *artificial respiration*.

a. *Chlorine* is the most powerful of these. It was first proposed by Riauz in 1822. It has been subsequently strongly recommended by Buchner, Simcon, and Orfila. It should be applied both internally and externally, if possible. If chlorine water be at hand, this should be given in doses of one or two teaspoonfuls properly diluted with water. In the absence of this, weak solutions of the chloride

¹ *Lect. on the Nerv. Syst.* p. 155.

[hypochlorite] of lime, or the chloride [hypochlorite] of soda, may be administered. Nitro hydrochloric acid, largely diluted, might be given where none of the above agents could be procured. The patient should be allowed to inhale, very cautiously, air impregnated with chlorine gas (developed by the action of dilute hydrochloric acid on chloride of lime). Enemata containing chlorine water, or a solution of chloride of lime, should also be employed.

β. *Ammonia*.—The spirit of sal ammoniac was proposed by Mead¹ as an antidote for laurel-water. In 1822, ammonia was recommended by Mr. J. Murray, as an antidote for hydrocyanic acid; and its value has been admitted by Buchner, Orfila, Depuy, and Herbst; but it is certainly inferior to chlorine, and, therefore, should be used only in the absence of this. If the patient should be able to swallow, the liquor ammoniæ, diluted with eight or ten parts of water, should be exhibited, and the vapour of ammonia or its carbonate inhaled; the latter practice is most important, and should not be omitted. Orfila says that ammonia is of no use when introduced into the stomach, but that the inhalation of the vapour will sometimes preserve life. Great caution is requisite in the employment of it. In the absence of ammonia the inhalation of the vapour of burnt feathers might be employed. Ammonia cannot be useful, as an antidote, by its chemical properties merely, since hydrocyanate of ammonia is a powerful poison.

γ. *Cold Affusion* has been strongly recommended by Herbst,² and is admitted by Orfila to be a valuable remedy. Herbst says that its efficacy is almost certain when it is employed before the convulsive stage of poisoning is over, and that it is often successful even in the stage of insensibility and paralysis. [This statement has been confirmed by the results of experiments on animals.—ED.]

δ. *Artificial Respiration* ought never to be omitted. Of its efficacy I am convinced from repeated experiments on animals. I once recovered a rabbit by this means only, after the convulsions had ceased, and the animal was apparently dead. It is an operation easily effected, and will be found a powerful assistant to chlorine or ammonia, by enabling it to get into the lungs when natural respiration is suspended. To produce respiration, make powerful pressure with both hands on the anterior surface of the chest, the diaphragm being at the same time pushed upward by an assistant. Inspiration is effected by the removal of the pressure, and the consequent resiliency of the ribs.

Other remedies (as turpentine, and the mixed hydrated oxides of iron) have been recommended, but they will not bear comparison with those now mentioned. Bloodletting has been advised, in vigorous subjects, when respiration has been established, and the skin is livid.³

[TRIBE II.—SPIRÆÆ.

GILLENIA TRIFOLIATA, Moench.—INDIAN PHYSIC.

Sex. Syst. Icosandria, Pentagynia.

Gillenia, U. S.—The Root.

Gen. Char.—*Calyx*, sub-campanulate, border five-toothed. *Corolla*, partly unequal. *Petals* five, lanceolate, attenuated, coarctate at the claws. *Stamina* fewer, included. *Styles* five, contiguous. *Stigmas* capitate. *Capsule* five-celled; cells two-seeded. (Nuttall.)

Sp. Char.—*Leaves* tennate, upper folioles lanceolate, serrate, subequal; lower folioles obtuse, with an abrupt, acute termination. *Stipules* linear, entire. *Flowers*, terminate, loosely paniculated, five gynous. *Petals* linear, lanceolate, obtuse. *Calyx*, tubulose, campanulate, ventricose. *Stamina*, included. *Capsule* five-celled, many-seeded.

¹ *Mechan. Account of Poisons*, 5th edit. p. 275, 1756.

² *Archiv. f. Anat. et Phys.* 1825; quoted by Dr. Christison.

³ Devergie, *Méd. Lég.* t. ii. p. 825; also Lonsdale, *op. supra cit.*

This plant is the *Spiræa trifoliata* of Linnæus, but the generic name was altered by Moench to the present one. The common names are *Indian physic*, *Indian hippo*, *Dropwort*, and *Bowman's Root*.

Hab.—This species is found scattered over the United States from Canada to Florida, on the eastern side of the Alleghany Mountains, occurring in open hilly woods, in light gravelly soil. The period of flowering is May, and the fruit is matured in August. The flowers are white, or of a rose tint.

The root is perennial, composed of a great number of fibres, arising from a common rough and irregular dark-coloured tube or head. These fibres are about the thickness of straws, many inches in length, irregular in thickness, with somewhat of an undulated form. When dried, the root is of a reddish-brown colour, wrinkled, and composed of an easily separable cortical portion and an internal ligneous cord. The external part is readily reduced to powder. It has a feeble odour and a bitter taste.

CHEMICAL COMPOSITION.—Some experiments upon the root of *Gillenia trifoliata* have been made by Mr. Shreeve (*Am. Journ. of Pharmacy*, vol. vii. p. 28), who found that it contained *starch, gum, resin, wax, fatty matter, red colouring matter, volatile colouring matter, and a peculiar principle*, soluble in alcohol and the dilute acids, but insoluble in water and ether. It contains nothing like *emetina*, according to the statement of Dr. Staples.

MEDICAL PROPERTIES.—*Gillenia* is a safe emetic, operating without violence in the appropriate dose. In small doses it is a stimulant and tonic to the stomach. It is stated that a knowledge of its medicinal operation is derived from the aborigines.

USES.—Although the testimony is strong in favour of the decided medicinal action of the root under consideration, its claims to confidence have been shaken by the report of Dr. Baum, who experimented with it, and was led to the conclusion that too much power had been attributed to it. Dr. Griffith (*American Journ. of Pharm.* vol. iv. p. 181) remarks, however, that he does not think Dr. Baum's experiments are sufficient to induce us to reject an article which has received the united testimony of the members of the profession, who speak of it in the highest terms, and recur to its use with as much confidence as to the true *Ipecacuanha*. The statements in its support are by Dr. B. S. Barton (*Collections*, p. 27), who says: "I can speak with more confidence of the *Spiræa trifoliata*. It is a safe and efficacious emetic in doses of thirty grains. Along with its emetic it seems to possess a tonic power." And Dr. W. P. C. Barton declares that country people have frequently used the plant so incautiously as to be under the necessity of resorting to medical aid. (*Veg. Mat. Med.* U. S. vol. i. p. 69). Dr. Eberle observes: "From my own experience with this plant, which has not been inconsiderable, I am led to regard it as very little inferior to the officinal *Ipecacuanha* as an emetic." To these may be added, Dr. Zollickoffer and Professor Bigelow.

The cases to which it is applicable are intermittent and remittent fevers, in the commencing stages, and bowel affections, as diarrhoea and dysentery. It may also be beneficial in some forms of dyspepsia.

ADMINISTRATION.—The mode of administration is in the form of powder or strong infusion. The dose of the powder is gr. xxx for its emetic effect; in doses of grs. ij or grs. iv it acts as a tonic.

The *Gillenia stipulacea* replaces the *G. trifoliata* on the western side of the Alleghany range. It is readily distinguished by the pinnatifid lower leaves, the upper being trifoliate, incised, serrate; and the foliaceous, oblique, jagged, stipules. The root is analogous to the preceding, and may be used under the same circumstances.

—J. C.]

TRIBE III. DRIADÆÆ.

264. GEUM URBANUM, Linn.—COMMON AVENS. HERB BENNET.

Sex. Syst. Icosandria, Polygynia.

HISTORY.—Pliny¹ speaks of the medicinal properties of Geum.

BOTANY. **Gen. Char.**—Tube of the *calyx* concave; limb 5-cleft, externally 5-bracteolate. *Petals* 5. *Stamens* numerous. *Carpels* juiceless, tailed, disposed in a head. *Style*, after flowering, articulate or barbed. *Seed* ascending.—Herbs. *Leaves* variously pinnatisect. (De Cand.)

Sp. Char.—*Stem* erect, branched, hairy. *Leaves* radical quinate-pinnatisect; caulinar ones ternate-palmatisect, with ovate, broadly-toothed, crenate lobes; upper ones 1-lobed, ovate. *Stipules* somewhat orbicular, large. *Petals* obovate, as long as the calyx. *Capillary head* spherical. *Ovaries* hairy, numerous. *Styles* smooth, with somewhat hairy appendices. (De Cand.)

Root of many brown fibres. *Stem* 1 or 2 feet high. *Leaves* grass-green, veiny, hairy. *Flowers* terminal, solitary. *Petals* bright yellow.

Hab.—Indigenous. Growing in woods, hedges, and dry shady places.

DESCRIPTION.—The root (*radix caryophyllatæ*, seu *gei urbani*, vel *sanamundæ*) consists of a rootstalk of from one to three inches long, from which issue a considerable number of cylindrical fibres. Externally it is brownish; internally reddish. When recent, its odour is aromatic and clove-like; but this is greatly diminished by drying. Its taste is aromatic, astringent, and bitterish. It should be gathered in the spring.

COMPOSITION.—The root has been the subject of repeated chemical experiment. Thus it was examined by Muehlenstedt,² Anjou,³ Bouillon-Lagrange,⁴ Melandri and Moretti,⁵ and Trommsdorff.⁶ The latter chemist found the constituents of the dried root to be as follows: *volatile oil* 0.039, *resin* 4, *tannin* soluble in alcohol and water 10, *tannin* insoluble in alcohol and ether, with traces of *chlorides*, 31, *gum* 15.8, *bassorin* 9.2, *ligneous fibre* 30 [excess 0.039].

PHYSIOLOGICAL EFFECTS.—Aromatic, tonic, and astringent.

USES.—Scarcely employed as a medicine in this country. [The root was formerly introduced into the *Materia Medica* of the Dublin College. In the last edition of the *Pharmacopœia* it is not mentioned.—ED.] It has been used in chronic diarrhœa and dysentery, leucorrhœa, chronic hemorrhages, and intermittents. It is put into ale, to communicate an agreeable clove-like flavour, and to prevent the liquor turning sour. Infused in wine, it has been used as a stomachic.

ADMINISTRATION.—Dose, ʒss to ʒj, in powder or decoction, three or four times a day.

265. POTENTILLA TORMENTILLA, Sibthorp, L.—COMMON TORMENTIL, OR SEPTFOIL.

Tormentilla officinalis, Smith, D.—Tormentilla erecta, Linn.

Sex. Syst. Icosandria, Polygynia.

(Rhizoma, L.)

HISTORY.—Sprengel⁷ considers this plant to be the *πεντάφυλλον* of Hippocrates, Theophrastus, and Dioscorides. But Sibthorp⁸ considers the latter plant to have been the *Potentilla reptans*.

¹ Hist. Nat. xxvi. 21, ed. Valp.² Ann. de Chim. liv. 287.³ Pfaff, Mat. Med. vi. 255.⁴ Prodr. Fl. Græcæ, i. 352.⁵ Murray, App. Med. iii. 123.⁶ Bull. de Pharm. ii. 393.⁷ Hist. Rei Herb. i. 43, 93, 176.⁸ Ibid.

BOTANY. Gen. Char.—Tube of the *calyx* concave; limb 4- or 5-cleft, externally 4- or 5-bracteolate. *Petals* 4 or 5. *Stamens* numerous. *Carpels* numerous. *Style* lateral. *Receptacle* procumbent, persistent, juiceless, capitate. *Seed* appended.—*Herbs* or *under-shrubs*. *Leaves* compound. *Stipules* adnate to the petioles. *Flowers* white, yellow, rarely red. (De Cand.)

Sp. Char.—Multiform, hairy. *Root* tuberous. *Stem* ascending, dichotomous. *Leaves* ternate-palmatisect, the caulinar ones sessile; lobes obovate-wedge-shaped, more or less deeply toothed. *Stipules* 0- or 3-toothed. *Flowers* axillary, solitary, with long peduncles. *Bracts* palmate-incised. Segments of the *calyx* lanceolate-linear, as long as the corolla. *Carpels* rugose. *Receptacles* villose. (De Cand.)

Stems weak, slender, often procumbent, branched. *Leaves* dark-green, somewhat hairy, especially the veins. *Flowers* bright yellow.

Hab.—Indigenous; growing on barren pastures, heaths, and bushy places.

DESCRIPTION.—The root (*radix tormentillæ*) is large, compared with the size of the plant. Its external form is very irregular: sometimes it is more or less cylindrical, at others tuberculated and knobby. Its colour externally is dark red-brown, internally flesh-red or brownish. Its taste is astringent. Its watery infusion is coloured blackish-green (*tannate of iron*) by the sesquichloride of iron. A solution of gelatine causes a precipitate (*tannate of gelatine*) in it. By iodine, starch is detected in the root.

COMPOSITION.—Neumann¹ and Pfaff² submitted tormentilla root to a chemical investigation. Meissner³ made an analysis of it, and found the constituents to be as follows: *volatile oil* a trace, *tannin* 17.4, *colouring matter* 18.05, *ditto* altered 2.57, *resin* 0.42, *cerin* 0.51, *myricin* 0.20, *gummy extractive* 4.32, *gum* (pectin?) 28.20, *extractive* 7.70, *woody fibre* 15.0, and *water* 6.45 (excess 0.82).

PHYSIOLOGICAL EFFECTS.—Astringent and tonic.

USES.—Employed in chronic diarrhœa and dysentery, passive hemorrhages, and intermittents. The decoction is also used as an astringent wash and injection; as in flabby ulcers and leucorrhœa. In the dysenteries of cattle it is reputed efficacious. In the Feroe and Orkney Islands it is used to tan leather; in Lapland, as a red dye.

ADMINISTRATION.—Dose, ʒss to ʒj, in powder or decoction, three or four times a day.

DECOCTUM TORMENTILLÆ, L.; Decoction of Tormentilla.—(Tormentil, bruised, ʒij; Distilled Water Oiss. Boil down to a pint, and strain.)—Astringent and tonic. Used internally in chronic diarrhœa.—Dose, fʒj to fʒij. Sometimes employed as an injection in leucorrhœa.

TRIBE IV. ROSEÆ.

266. ROSA CANINA, Linn. L. E.—COMMON DOG-ROSE.

Sex. Syst. Icosandria, Pologynia.

(Fructus recens, L.—Hip of *R. canina*, and of several allied species, deprived of the carpels, E.—Fructus, D.)

HISTORY.—The *κυνόροdon*, or *Dog-rose* of Hippocrates,⁴ is, perhaps, *Rosa canina*, Linn., which, according to Sibthorp,⁵ is a native of Greece. Pliny⁶ speaks of *Rosa sylvestris*, which he says is called *cynorrhodon* (i. e. *Dog-rose*); but as he describes the *sponge* as growing on it, he probably referred to *Rosa rubiginosa* (*Sweetbrier*, or *Eglantine*), on which it is more frequently found than on any other species.

BOTANY. Gen. Char.—Apex of the tube of the *calyx* contracted, the limb

¹ *Works*, by Lew s. p. 362.

² *Gmelin, Handb. d. Chem.* ii. 1269—70.

³ *Prod. Fl. Græc.* i. 349.

⁴ *Mat. Med.* ii. 210.

⁵ *Opera*, p. 587, ed. Fæss.

⁶ *Hist. Nat. lib.* xxv. cap. 6, ed. Valp.

5-parted; segments during æstivation somewhat spirally imbricated at the apex, often pinnatisect. *Petals* 5. *Stamens* numerous. *Carpels* many, inserted on the calyx, subsequently baccate, inclosed within the calyx, dry, indehiscent, somewhat crustaceous, bearing the style on the inner side. *Styles* exerted from the narrowed tube of the calyx, free or aggregated into a columnar style. *Seed* in an akenium, solitary, exalbuminous, inverted; *embryo* straight; *cotyledons* flat. *Shrubs* or small *trees*. *Leaves* pinnate, with an odd one; leaflets serrate. *Stipules* adnate to the petiole. (De Cand.)

Sp. Char.—*Prickles* uniform, hooked. *Leaves* naked or slightly hairy; their disk eglandulose. *Calyx-segments* fully pinnate, deciduous. *Styles* not united. *Shoots* assurgent (Hooker).

The British roses answering to these characters are subdivided by Hooker (*British Flora*) as follows:—

α. *R. canina* Woods, Smith. *Leaflets* carinate; serratures simple.

β. *R. sarmentacea* Woods, Smith; *R. canina*, Curtis. *Leaflets* naked, carinate; serratures compound.

γ. *R. surculosa* Woods; *R. canina* β, Smith. *Leaflets* naked, flat; serratures simple.

δ. *R. dumetorum* Woods, Smith. *Leaflets* more or less hairy, flat.

ε. *R. Fosteri*, Smith; *R. collina*, Woods. *Leaflets* more or less hairy, not flat.

De Candolle¹ admits no less than nineteen varieties of *R. canina*, Linn.

Ramification variable in denseness. *Shoots* more or less arched or erect, according to the vigour of the plant. *Prickles* not very numerous, hooked in various degrees, and compressed; their base considerably dilated. *Leaflets* variable in width; their serratures, although scarcely compound, except in β, are mostly irregular in size. *Bracts* variable in size. *Peduncle* and *calyx-tube* commonly naked; their setæ, when present, feeble, and not numerous; *calyx-segments* free from glands, or more or less copiously fringed with them. *Styles* hairy. *Fruit* coral-red, or more scarlet [usually oblong, elliptical or ovate, rarely somewhat globose], soft and pulpy when ripe, with a pleasant somewhat acid taste (Hooker).

Hab.—Indigenous. Thickets, hedges, &c.; very common. Flowers in June and July. Perennial.

DESCRIPTION.—The fruit used in medicine under the name of the *hip* or *hep* (*fructus rosæ caninæ* seu *f. cynosbati*), is oval, composed externally of the persistent calyx, whose sides have become thick, fleshy, beautifully red, shining; and internally, of numerous, hard, hairy akenia (commonly called seeds, but which, in fact, are the carpels, or real fruits), containing each an exalbuminous seed. The pulp or fleshy matter of the persistent calyx is sweet, acidulous, and pleasant to the taste, especially when mellowed by the frost. The hairs surrounding the akenia act as mechanical irritants, like the hairs of the pods of the cowhage, and when swallowed, are apt to occasion gastric uneasiness, vomiting, and pruritus about the anus.

COMPOSITION.—According to Bilz,² 100 parts of the dried ripe fruit, deprived of akenia and hairs, consist of the following substances: *volatile oil* a trace, *fatty oil* 0.065, *muricin* of the scale 0.05, *soft resin* of the pulp 1.419, *reddish-yellow hard resin* 0.463, *tannin* 0.260, *uncrystallizable sugar* 30.6, *gum* 25.0, *epidermis* 4.552, *medullary fibre* 14.0, *citric acid* 2.95, *malic acid* 7.776, *citrates*, *malates*, *mineral salts*, *water* (and loss) 12.865.

PHYSIOLOGICAL EFFECTS AND USES.—The pulp is nutritive, and slightly refrigerant and astringent. It is only employed in medicine in the preparation of a conserve.

CONFECTIO ROSÆ CANINÆ, L.; *Conserve Rosæ Fructûs*, E.; *Conserve Cynosbati*; *Conserve of Dog-Rose*; *Conserve of Hips*.—(Dog-Rose Hb. j; Sugar, powdered, 3xx. Beat up the rose with the sugar added by degrees until they become one mass, L. Take any convenient quantity of Hips, carefully deprived of their carpels; beat them to a fine pulp, adding, gradually, thrice their weight of white sugar, E.)—In

¹ Prodr. ii. 613.

² Gmelin, Handb. d. Chem. ii. 1270.

the preparation of this conserve, the akenia or carpels (commonly termed seeds), with their hairs, must be carefully separated, on account of the irritation they are apt to occasion (see above). It is probable that the fruit of several varieties (or species?) are employed indiscriminately in the preparation of this conserve. The observation of Sir J. E. Smith deserves notice, that the fruits, casually gathered late in autumn, present a great diversity of flavour.¹ This conserve, being saccharine and acidulous, is nutritive and refrigerant. It is usually employed as a convenient and agreeable vehicle for other remedies; as for a pill-basis, or for the making of electuaries or linctuses. A very agreeable pectoral linctus containing almond oil, and, sometimes, syrup of poppies, is made with this conserve, acidulated with dilute sulphuric acid. A drawback to the use of this conserve is its tendency to candy or concrete by keeping.

267. ROSA GALLICA, Linn. L. E. D. [U. S].—FRENCH OR RED ROSE.

Sex. Syst. Icosandria, Pologynia.

(*Petalum nondum explicatum recens et exsiccatum*, L. D.—Petals, E.)

HISTORY.—Perhaps our red rose may be the *Rosa Miliesia* of Pliny², the colour of which, he says, was very warm [*ardentissimus*], and whose petals did not exceed twelve in number. The *Rosa Trachinia*, he adds, stands next to this, but is less red.

BOTANY. *Gen. Char.*—See *Rosa canina*.

Sp. Char.—*Prickles* unequal. *Stipules* narrow, straggling at the point. *Leaflets* 5 to 7, coriaceous, rigid, ovate or lanceolate, deflexed. *Flower-bud* ovate-globose. *Sepals* spreading during flowering. *Fruit* somewhat globose, very coriaceous. *Calyxes* and *peduncles* more or less very finely glandulose-hispid, somewhat viscous. (De Cand.)

A small *shrub*. Very variable in *form*.—De Candolle³ admits twelve distinct varieties. Mr. G. Don⁴ enumerates more than two hundred sorts cultivated by gardeners. And we are told⁵ that the Dutch cultivators have more than five hundred varieties. The variety cultivated at Mitcham, where it is called the *Damask Rose*, appears to me to be *R. gallica* var. *δ officinalis*, De Candolle.

Hab.—South of Europe. Common in gardens. For medicinal purposes cultivated at Mitcham.

DESCRIPTION.—The dried petals of the unexpanded flowers, deprived of their white claws or heels (*ungues*), constitute the *red-rose leaves* (*flores rosæ rubræ*) of the shops. The flower-buds are brought to market when about the size of a large nutmeg. The calyx and claws being cut off, the petals are speedily dried. At Mitcham, this is effected in a stove. Slow desiccation impairs both their astringency and colour. The petals of the buds are much more astringent than of the full-blown flowers; hence they are preferred for medicinal use. When dried, they are sifted to remove the stamens, and insects. 2,000 flowers yield about 100 lbs. of fresh, or 10 lbs. of dried petals. The dried petals have a velvety appearance; their colour is purplish-red; their odour, which is principally developed during desiccation, is agreeable; their taste is bitterish and astringent. As they lose their fine colour when exposed to light and air, and are apt to become mouldy or worm-eaten, they should be carefully preserved in bottles or canisters.

COMPOSITION.—The petals were analyzed by Cartier,⁶ who found the following substances: *volatile oil*, *colouring matter*, *tannin*, *gallic acid*, *fatty matter*, *albumen*, *soluble potash salts*, *calcareous insoluble salts*, *silica*, and *oxide of iron*.

1. **ASTRINGENT MATTER** (*tannic and gallic acids*).—The presence of astringent matter is

¹ Eng. Fl. ii. 395.

² Prodr. ii. 603.

³ Journ. de Pharm. xii. 443.

⁴ Hist. Nat. lib. xxi. cap. 10, ed. Vulp.

⁵ System of Gardening.

⁶ Ibid. vii.

shown by the very dark colour (*tannate and gallate of iron*) produced in an infusion of red roses by the ferruginous salts, and by the slight precipitate (*tannate of gelatine*) caused on the addition of a solution of gelatine.

2. **COLOURING MATTER.**—Has not yet been isolated. A watery infusion of red rose leaves has a pale yellowish-red colour; the alcoholic tincture is also pale-coloured. On the addition of sulphuric acid, an intense bright red colour is produced (*sulphate of the colouring matter*). Alkalies communicate a greenish tint to the watery infusion (probably by neutralizing the free acid, to which, with the colouring matter, the red tint is owing). Sulphurous acid destroys the colour of the infusion of roses (*sulphite of colouring matter?*); but on the addition of sulphuric acid the intense bright red (*sulphate of ditto*) is produced with an evolution of sulphurous acid gas. Dr. Clarke and others had supposed that the red colour was owing to iron; but both Gay-Lussac and Cartier found more iron in white than in red roses. Thus 1000 grains of the white rose yielded the latter chemist 99 grains of ashes containing 12.4 of iron; while the like quantity of the red rose yielded 50 grains of ashes, in which were only four grains of oxide of iron.

PHYSIOLOGICAL EFFECTS AND USES.—Red rose leaves are mild astringents and tonics; but their power is exceedingly slight, and scarcely deserves notice. By the Arabian physicians, Avicenna and Mesue, as well as by more recent writers, Riverius, Kruger, and others, conserve of roses was esteemed a valuable remedy in phthisis.¹ At the present time, red rose leaves are principally used for their colour and flavour. They yield several official preparations, which are valuable as forming elegant vehicles for the exhibition of other more active medicines. The full-blown flowers are said to be as laxative as those of *R. centifolia*. "Poteries relates, that he found a drachm of powdered red roses occasion three or four stools, and this not in a few instances, but constantly, in an extensive practice for several years."²

1. **INFUSUM ROSÆ COMPOSITUM, L.** [*U. S.*]; *Infusum Rosæ, E.*; *Infusum Rosæ acidum, D.*; *Infusion of Roses.*—(Petals of the Red or Gallic Rose, dried, ʒiij [ʒij. *D.*]; Diluted Sulphuric Acid ʒiiss; Sugar [pure, *E.* ʒj.] ʒvj; Boiling Water [distilled, *L.*] Oiss. Pour the Water upon the Rose petals previously pulled asunder; then mix in the Acid. Macerate for two hours [one hour. *D.*], and strain the liquor; lastly, add the sugar to it, *L.* Infuse the petals for one hour in the water, in a covered vessel, strain, and add the acid. The product should measure about eight ounces, *D.* The *Edinburgh College* infuses the petals in the water for four hours in a vessel of glass or porcelain, not glazed with lead; then adds the acid, strains through linen or calico, and dissolves the sugar in the strained liquor.)—The lengthened maceration of six, or even four hours, is unnecessary. An hour, as recommended by the Dublin College, or perhaps even half an hour, is quite sufficient. [The *U. S. Pharm.* directs of Red Roses ʒss; Boiling Water Oiss; Diluted Sulphuric Acid ʒiij; Sugar ʒiiss. Pour the Water upon the Roses in a glass vessel; then add the acid, and macerate for half an hour; lastly, strain the liquor and add the sugar.] Infusion of roses is a mild, but very agreeable refrigerant and astringent, and is a very pleasant drink in febrile disorders, hemorrhages, diarrhoea, and colliquative sweats. It forms a very elegant vehicle for other medicines; as for saline purgatives (especially sulphate of magnesia, the unpleasant taste of which it serves greatly to cover), for disulphate of quinia (which is dissolved in the water by the free sulphuric acid, which also serves to prevent the tannic acid of the roses precipitating the quina),³ the mineral acids, bitter tinctures, and infusions, alum, &c. It serves as a very useful gargle; for which purpose acids, nitre, alum, or tincture of capsicum are usually conjoined. Of course, the alkalies and the earths, as well as their carbonates, are incompatible with it; they neutralize the acid, and change the colour of the preparation to green or brownish green. Sulphate of iron communicates a deep olive colour, and after some hours causes a precipitate. The sulphuric acid of the infusion of roses decomposes and destroys the activity of the acetate of lead, by forming sulphate of lead. It is a common practice, however, though of course among ignorant practitioners only, to administer, in hemorrhages, a pill composed of acetate of lead and opium, and at the same time infusion of

¹ Murray, *App. Med.* iii. 168.

² Lewis, *Mat. Med.*

³ Mr. Squire says that sulphuric acid does not dissolve the tannate of quinia, but that nitric acid does.

roses (?)¹ The dose of infusion of roses is fʒj to fʒij. Each fʒj contains mivss. of dilute sulphuric acid, which are nearly equivalent to three-sevenths of a minim of strong sulphuric acid.

2. CONFECTIO ROSÆ, L. D. [U. S.]; *Conserve Rosæ*, E.; *Conserve of Red Roses*. (Petals of the Red Rose lb. j; Sugar, lb. iij. Beat the rose petals in a stone mortar; then, the sugar being added, beat them again until they are thoroughly incorporated, *L.*—Beat the petals of the Rosa gallica to a pulp, gradually adding thrice their weight of white sugar, *E.*—Dried petals of the Gallic Rose ʒj; Rose Water fʒij; Refined Sugar ʒiij. Macerate the petals in the rose water for two hours, add the sugar gradually, and beat them into a uniform mass. Or, take of fresh petals of the Gallic Rose, three ounces; Refined Sugar eight ounces; rub the petals in a mortar, then add the sugar gradually, and beat them together until they are intimately mixed, *D.*—The Dublin confection contains the largest quantity of rose leaves, and the London the least.)—[The U. S. Pharmacopeia directs Red Roses in powder, four ounces; Sugar in powder, thirty ounces; Clarified Honey six ounces; Rose Water eight fluidounces. Rub the Roses with the Rose Water at a boiling heat, then add gradually the Sugar and Honey, and beat them together until thoroughly mixed.] This preparation is slightly astringent. It was formerly much esteemed in phthisis. Its principal use now is as a vehicle for the exhibition of other medicines. Thus it is a common pill-basis for calomel, disulphate of quinia, &c. *Pilulæ hydrargyri* are prepared with it. Alone, or conjoined with the confection of dog-rose, it forms the basis of some elegant pectoral linctuses or electuaries, containing almond oil, diluted sulphuric acid, or syrup of poppies. Over the confection of dog-rose it has the advantage of having no tendency to candy. Furthermore, it does not ferment or become mouldy.—Dose, ʒj to ʒij, or more.

3. MEL ROSÆ, L. E. [U. S.]; *Honey of Roses*.—(Dried Red Rose ʒiv; Boiling Distilled Water ʒxxiv; Honey lb. v. Macerate the rose petals, first separated, in ʒxvj of the water, for two hours; then lightly press with the hand, and strain; what remains macerate again for a little time in the rest of the water, and pour off the liquor; to this add the half of the first infusion, and set aside the other half; then to the honey add the mixed liquors, and evaporate in a water-bath, so that the solution which was set aside being added, it may become of a proper consistency, *L.*—The Edinburgh College directs the same weight of the petals of the rose and of honey. The petals are to be infused in the water for six hours, then strained and squeezed, mixed with the honey, and the liquid evaporated.) *Ed.*—[The U. S. Pharm. directs of Red Roses in coarse powder ʒij; Clarified honey ʒxxij; Boiling water fʒxij. Macerate the Roses in fʒvij of Boiling Water for four hours, in a glass or earthen vessel; then with strong pressure remove as much as possible of the infusion and set it aside. Macerate the residuum in four fluidounces of boiling water for half an hour, and again express. Reserving four fluidounces of the first infusion, mix the remainder with the infusion last obtained, add the honey, and by means of a water-bath, evaporate to a pint. Lastly, add the reserved infusion, and strain.]—A mildly astringent and very agreeable preparation, principally employed in the diseases of children. It is used sometimes alone as a mild detergent in slight aphthous affections, or inflammatory conditions of the mouth and throat; or as an agreeable vehicle for the exhibition of other more powerful medicines. It is occasionally added to detergent or astringent gargles.—Dose, for children, ʒj.

4. SYRUPUS ROSÆ GALLICÆ, E. D.; *Syrup of Roses*.—(Dried Red Rose petals ʒij; Boiling Water Oj; Pure Sugar ʒxx. Proceed as for the syrup of damask rose, *E.*—Take of petals of the Gallic Rose, dried, ʒij; Boiling Distilled Water Oj; Refined Sugar, in powder, as much as is sufficient. Boil the petals in the water in a

¹ [Experience shows, however, that the alternation of doses of such pills and mixture every few hours is an effective mode of treating many forms of hemorrhage, especially hemoptysis.—*Ed.*]

glass or porcelain vessel, until their colour is completely extracted; strain by expression, and let the decoction stand until the sediment subsides; then, having decanted the supernatant liquor, add to it twice its weight of sugar, and dissolve with the aid of steam or water heat, *D.*)]—This syrup, though very slightly astringent, is principally valuable for its red colour, on account of which it is sometimes added to mixtures and electuaries, (as the *Electuarium Catechu*, *E.*)

268. ROSA CENTIFOLIA, Linn. L. E. D. [U. S.]—THE HUNDRED-LEAVED OR CABBAGE ROSE.

Sex. Syst. Icosandria, Polygynia.

(*Petalum recens*; Petala, *L.*—Petals; Volatile oil of the petals, *E.*)

HISTORY.—Theophrastus¹ speaks of a *Rosa centifolia* (Ῥόδον ἑκατονάφυλλα) which grew abundantly about Philippi. Herodotus² mentions a rose growing naturally in Macedonia, and which had sixty leaves, and more than ordinary fragrance. This perhaps was *R. centifolia*. Pliny³ also notices the *R. centifolia*.

BOTANY. **Gen. Char.**—See *Rosa canina*.

Sp. Char.—*Prickles* nearly straight, scarcely dilated at the base. *Leaflets* 5 to 7, ovate, glandular and flaccid at the margin, hairy beneath. *Flower-bud* ovate, short. *Sepals*, during flowering, spreading, not deflexed. *Fruit* ovate, somewhat pulpy. *Calyces* and *peduncles* glandulose-hispid, rigid, fragrant. (De Cand.)

De Candolle admits seventeen distinct varieties. In gardens are found above eighty sorts. One of the best known of them is the *Moss Rose* (*R. Muscosa*). At Mitcham, the sort cultivated for medicinal purposes, under the name of the *Provins* or *Cabbage Rose*, appears to me to agree with the var. *α vulgaris foliacea* of De Candolle. Its *leaflets* are oval or rounded-oval. The larger *prickles* slightly falcate.

Hab.—Asia. Cultivated at Mitcham, and other places, for medicinal purposes.

DESCRIPTION.—The petals of the hundred-leaved rose (*flores rosæ centifoliæ seu pallidæ*) are commonly termed in the shops *Provins* or *Cabbage-rose leaves*. They should be gathered when the flowers are full blown, and before the petals begin to fall. Their odour is strongest when they are of a fine pale red, and before they begin to fade. When freed from the calyx cups and stamens, they are to be dried in the air. Unlike the petals of *R. gallica*, desiccation diminishes their fragrance. Their odour is said to be singularly exalted by iodine.⁴ Their taste is sweetish, though somewhat acidulous and bitter. To preserve rose leaves, they are frequently pickled or salted (*flores rosæ saliti*) like elder flowers.

COMPOSITION.—I am unacquainted with any analysis of the petals of the *Rosa centifolia*. The following, however, may be regarded as the ascertained constituents: *volatile oil*, *gallic* (and tannic?) *acid*, *colouring matter*, a *saccharine matter* (sweet extractive of Pfaff), *woody fibre*, *mineral salts*, and *oxide of iron*.

1. **VOLATILE OIL** (see page 801).

2. **LAXATIVE PRINCIPLE** (*Sweet Extractive* of Pfaff).—The nature of the laxative principle of the hundred-leaved rose has scarcely been examined. Pfaff⁵ declares it to be sweet extractive.

PHYSIOLOGICAL EFFECTS AND USES.—The petals are mildly laxative, and are employed, on this account, in the form of syrup (see *Syrupus Rosæ*).

On account of its delightful fragrancy, this rose is in common use for nosegays and scent-bags, and is employed for the distillation of *rose water*. Its odorous emanations, however, are not always innocuous; but on some persons have acted as a poison,⁶ causing symptoms which, for the most part, are those indicating a disordered condition of the cerebro-spinal system—such as headache, fainting, and

¹ *Hist. Plant.* vi. 6.

² *Hist. Nat. lib.* xxi. cap. 10, ed. Valp.

³ *Mat. Med.* Bd. iv. S. 277.

⁶ See Murray, *App. Med.* iii. 160; Orfila, *Toxicol. Gén.*

² *Urania*, cxxxviii.

⁴ Chereau, *Journ. de Pharm.* xii. 442.

hysterical symptoms; and occasionally giving rise to local irritation, manifested by sneezing and inflammation of the eyes.

1. *SYRUPUS ROSÆ*, L.; *Syrupus Rosæ centifoliæ*, E.; *Syrup of Roses*; *Syrup of Damask Rose*.—(Rose Petals, dried, ℥vij [℥b. j, E.]; Sugar [pure, E.] lb. vj [lb. ij, E.]; Boiling Water Oij; [Rectified Spirit ℥vss, L.] Macerate the Rose Petals in the Water for twelve hours, and strain. Evaporate the strained liquor, in a water-bath, to Oij. Then add the sugar [dissolve with the aid of heat, E.] and strain; lastly, mix in the spirit, L.)—Gently laxative. Used only for young children. Dose, fʒij to fʒj. Its red colour is heightened by acids; alkalies change it to green or yellow.

2. *AQUA ROSÆ*, L. E. D. [U. S.]; *Rose Water*.—(Petals of *Rosa centifolia* lb. x [Rectified Spirit fʒiij, E.]; Water Cong. ij. Let a gallon distil.—“The petals should be preferred when fresh; but it also answers well to use those which have been preserved, by beating them with twice their weight of chloride of sodium,” E.) The *Dublin College* directs the Rose Water to be prepared by agitating mxx of essential oil of Roses with Cong. ss of distilled water, and filtering through paper.—[The *U. S. Pharm.* directs fresh Hundred-leaved Roses eight pounds; Water two gallons. Mix, and distil a gallon.]—Rose water is prepared both from fresh and pickled rose leaves, but of course the former are preferable. During its distillation, a solid volatile oil comes over with it, and floats on the water in the receiver. To prevent the water becoming sour, it should be preserved in well-corked bottles, kept in cool places. Spirit of wine ought not to be mixed with it, for if a sufficient quantity be added to preserve the water, it renders it unfit for some medicinal purposes. Rose water is employed, on account of its odour only, as an addition to lotions and collyria.

3. *OLEUM ROSÆ*, E.; *Attar or Otto of Roses*.—Obtained in the East, by distilling roses with water. The attar concretes and floats on the distilled water when cold.¹ In Northern India, rose water and attar are distilled from *R. damascena*.² The precise species of rose used at Ghazepoor, in Hindostan, where the attar is extensively distilled, as well as at Shiras, in Persia, has not been satisfactorily ascertained. At the latter place a rose with white flowers is said to be used.³ Is it *R. moschata*? In the manufacture of rose water in England, from *R. centifolia*, a crystalline volatile oil with the odour of the attar is frequently obtained (*English attar of roses*). Polier says that, to procure something less than three drachms of attar from 100 lbs. of rose leaves, in India, the season must be very favourable, and the operation carefully performed. Jackson states that from one lac of roses it is generally calculated that 180 grains, or one tolah of attar, can be procured. Heber⁴ says, 20,000 roses yield attar equal in weight to that of a rupee. According to Donald Monro,⁵ the attar is procured without distillation, merely by macerating the petals in water. But Trommsdorff⁶ tried the method, and failed to procure any oil. [It is, however, certain that, in India, attar is occasionally obtained by exposing the rose-leaves in water to the sun, when the oil floats out. Landerer states also that he has been informed by a person who was some years engaged in the manufacture, that attar is obtained at Damascus, and other parts of Asia Minor, by dry distillation of the rose at the temperature of a salt-water bath.⁷—Ed.]

Attar of roses is imported from Constantinople and Smyrna. The duty on it is 1s. 4d. per lb. In 1838, 973 lbs.; in 1839, 745 lbs. paid duty.⁸

At temperature below 80° F. attar of roses is a crystalline solid. It is usually almost colourless; but Polier says, colour is no criterion of its goodness, quality, or country. Undiluted, its odour is somewhat too powerful to be agreeable; but

¹ Polier, *Asiat. Research*. i. 332; Jackson, *Ed. New Phil. Journ.* xxviii. 326.

² Royle, *Illustr.* 203.

³ *Narrative*, i. 266.

⁴ Martius, *Pharmacogn.*

⁵ *Trade List*.

⁶ Fée, *Hist. Nat. Pharm.* ii. 127.

⁷ *Treat. on Med. and Pharm. Chym.* ii. 311.

⁸ *Pharm. Journ.* xi. 105.

when properly diffused through the air or some liquid, it is most delicious. It is combustible, and its vapour with oxygen forms an explosive mixture. It fuses at between 84° F. and 86° F. Its sp. gr. at 90° F. is 0.832; water at 60° F. being 1.0.¹ At 57° F. 1000 parts of alcohol (sp. gr. 0.806) dissolve 7 parts, and at 72° F. 33 parts of attar.

Attar of roses has been analyzed by Saussure and Blanchet, but their results do not accord.

Blanchet's Analysis.				Saussure's Analysis.	
	Atoms.	Eq. Wt.	Per Cent.		Per Cent.
Carbon	23	138	74.59	Carbon	82.053
Hydrogen	23	23	12.43	Hydrogen	13.124
Oxygen	3	24	12.98	Oxygen	3.949
Attar of Roses	1	135	100.00	Nitrogen	0.874
					100.000

Sandal-wood oil, oil of rhodium, some of the fixed oils, and spermaceti, have been said to be occasionally employed for adulterating attar of roses; but as far as my observation extends, the attar found in the shops of London is very pure.

Attar of roses consists of two volatile oils; one solid, the other liquid, at ordinary temperatures, in the proportion of about one part of the first to two parts of the second. To separate them, the attar is to be frozen and compressed between folds of blotting-paper, which absorbs the liquid and leaves the solid oil; or they may be separated by alcohol (of sp. gr. 0.8), which dissolves the liquid, but takes up scarcely anything of the solid oil.

a. Solid Oil of Roses (Rose Camphor; Stéaroptène of Oil of Roses).—Occurs in crystalline plates fusible at about 95° F. It is composed, according to Saussure, of carbon 86.743, and hydrogen 14.889; or an equal number of atoms of carbon and hydrogen. Blanchet states its composition to be, carbon 85.86, hydrogen 14.46. [The solid portion is insoluble in alcohol, but may be purified by solution in ether. In constitution it is isomeric with oil of turpentine, being represented by CH or some multiple of it.—Ed.]

b. Liquid Oil of Roses (Eléoptène of Oil of Roses).—This oil has not been accurately examined. From Saussure's analysis of the ordinary attar and of its stéaroptène, it would appear to contain oxygen and nitrogen, in addition to carbon and hydrogen. By calculation, the proportions appear to be, carbon 80.56, hydrogen 12.42, oxygen 3.92, nitrogen 1.3.² The presence of nitrogen has not been confirmed by the researches of other chemists.

Attar of roses is employed for scenting only. In the shops, various perfumes are sold which owe their odour to the attar. Thus *oil for the hair*, sold as *huile antique rouge à la rose*, is merely olive oil coloured by alkanet, and scented with the attar. *Milk of roses* also contains the attar. Several compound scents owe a portion of their fragrance to this oil; as *lavender water*. The Edinburgh College has very properly, as I conceive, introduced this oil into the Pharmacopœia; for, as medicines frequently require to be perfumed, I cannot conceive why the most delicious perfume should be excluded from the Materia Medica. It may be employed as an addition to unguents and spirit washes.

TRIBE V. POMACEÆ.

269. CYDONIA VULGARIS, Persoon, L. E.—THE COMMON QUINCE.

Pyrus Cydonia, Linn.

Sez. Syst. Icosandria, Pentagynia.

(Semen, L.)

HISTORY.—Hippocrates³ employed the quince-apple (χυδώνια) as an astringent in diarrhœa. The Romans called this fruit *malum cotoneum*.⁴

BOTANY. Gen. Char.—*Calyx* 5-cleft. *Petals* somewhat orbicular. *Stamens*

¹ Saussure, *Ann. Chim. et Phys.* xiii. 337.

² *Opera*, 497, ed. Fœs.

³ Dumas, *Traité de Chim.* i. 494.

⁴ Pliny, *Hist. Nat. lib. xv. cap. 11*, ed. Valp.

erect. *Styles* 5. *Pome* closed, 5-celled; cells many-seeded, cartilaginous. *Seeds* enveloped with mucilaginous pulp.—*Small trees*. *Leaves* undivided, quite entire or serrate. *Flowers* large, solitary or few, somewhat umbellate. (De Cand.)

Sp. Char.—*Leaves* ovate, obtuse at the base, quite entire; their lower surface, as well as the *calyx*, tomentose. (De Cand.)—A small, much-branched, usually crooked *tree*. *Petals* pale rose-colour or white. *Pome* varying in shape, yellow, covered with a thin cottony down, very austere, but having a peculiar fragrance.

De Candolle admits three varieties:—

♂. *Maliformis*. *Apple Quince*.—*Pome* almost globose. Cultivated.

♂. *Lusitanica*. *Portugal Quince*.—*Leaves* broader. *Pome* larger. Cultivated.

γ. *Oblonga*. *Oblong or Pear Quince*. *Leaves* oval or oblong. Cultivated and wild.

Hab.—South of Europe. Cultivated in gardens. Flowers in May and June.

DESCRIPTION.—Quince seeds (*semina cydoniæ*) are ovate-acute, flat on one side, convex on the other, and of a reddish-brown colour. The most external coat (*epidermis seminalis*, Bischoff) is composed of very fine cells, in which is lodged a large quantity of mucilage. When, therefore, these seeds are thrown into water, the mucilage swells up, distends, and ultimately bursts the tender cells.¹

COMPOSITION.—No analysis of either fruit or seeds has been made. The **FLESHY PULP** of the fruit contains an *astringent matter*, *malic acid*, *sugar*, *pectine*, or *vegetable jelly*, a *nitrogenous matter*, probably *volatile oil*, *water*, and *vegetable fibre*. The **SEEDS** contain *colouring matter*, *tannic acid*, a large quantity of a *peculiar gummy matter* in their outer coat, probably *amygdalin* (as Stockman obtained hydrocyanic acid from the seeds by distillation), *emulsin*, *starch*, *fixed oil*, and *woody fibre*.

CYDONIN (*Peculiar Gum of Quince Seed*; *Bassorin*; *Mucus*; *Quince Mucilage*).—One part of quince seed forms, with forty parts of water, a thick mucilage, which produces, with the following salts, gelatinous coagula or precipitates; acetate and diacetate of lead, protochloride of tin, nitrate of mercury, and sesquichloride of iron. Rectified spirit produces at first scarcely any effect; after some time partial coagulation is effected. Oil of vitriol communicates a pinkish tint, and causes the separation of a frothy coagulum, which floats on the mixture. Silicate of potash, infusion of nutgalls, and oxalate of ammonia, produce no change in the mucilage. Quince mucilage, usually termed bassorin, appears to me to be a peculiar substance: hence I propose to call it *cydonin*. It is distinguished from *arabine* (see *Gum Arabic*) by the effect on it of alcohol, silicate of potash, sulphuric acid, and oxalate of ammonia; from *bassorin* and *crasin* (see below) by its solubility in water, both hot and cold; from *tragacanthin* (see *Gum Tragacanth*) by the effect of sulphate of iron, oxalate of ammonia, and alcohol; from *carrageenin* by the effect of silicate of potash and acetate of lead.²

PHYSIOLOGICAL EFFECTS.—The *fruit* is not eatable in its raw state. Stewed in pies or tarts, along with apples, it is much esteemed. The expressed juice (*succus cydoniæ*) is said to be cooling and astringent. An excellent *marmalade* (*miva cydoniæ*) and *syrup* are prepared from the quince by the confectioner. The *mucilage of quince seed* is nutritive, demulcent, and emollient. The whole seeds, if taken in sufficient quantity, and well masticated, would, perhaps, act like bitter almonds, as they are said to yield hydrocyanic acid.

USES.—Quince seeds are employed in medicine only on account of the mucilage which they yield.

DECOCTUM CYDONII, L.; *Mucilage of Quince Seed*.—(Quince Seeds ʒij; Distilled Water Oj. Boil with a gentle heat for ten minutes, and strain.)—Never used internally. Employed externally as an emollient and sheathing application to cracked lips and nipples; to the inflamed conjunctiva; to the skin when affected with erysipelas; and to painful hemorrhoidal tumours. Hair-dressers use it, as a cement, for dressing the hair in braids.

¹ See Bischoff. *Handb. d. bot. Termin.* tab. xlii. fig. 1859.

² For some experiments on mucilage of quince seed, see Bostock, in *Nicholson's Journal*, vol. xviii. p. 31.

OTHER MEDICINAL ROSACEÆ.

I. THE KOSSO, KOUSSO, OR BRAYERA ANTHELMINTICA.¹

HISTORY.—*Kosso* has been used in Abyssinia as an anthelmintic for more than two centuries; for Leutholf (Ludolfi, *Historia Æthiopica*, lib. i. cap. ix. sect. 31, 1681) says that "N. Godingus" praises another tree as being very efficacious against *lumbrici*, which are produced by the use of raw meat. But the Abyssinians purge themselves every month with the fruit of this tree, and thus," he says, "destroy these worms." Now there can be little doubt, I conceive, but that this passage refers to the *kosso*.

Bruce, in his *Travels to discover the Source of the Nile, from 1768 to 1773* (vol. v. p. 73), published at London in 1790, mentions this medicine, which he calls *cusso*, and proposes to name the tree *Banksia Abyssinica*, after Sir Joseph Banks, the then President of the Royal Society. But the younger Linnæus, in the *Supplementum Plantarum*, published at Brunswick in 1781, had already appropriated the name of *Banksia* to a New Holland genus of proteaceous plants, and he has been followed by all succeeding botanists; so that it is obvious that Bruce's proposed botanical name for the *kosso* cannot be adopted.

Bruce gave a very good popular account of *kosso*, accompanied by what he justly terms "a true and exact" figure of the plant. I have compared his figures with a specimen of the plant collected in Abyssinia by Schimper, and contained in the herbarium of my friend Mr. N. B. Ward, and with the commercial flowers, and find that they are fair representations of the plant.

Bruce states that the Abyssinians evacuate once a month "a large quantity of worms; these are not the tape-worm, or those that trouble children, but they are the sort of worm called ascarides." This statement agrees with that of Godingus, just quoted; but it does not accord with the observations of other travellers, who tell us that the worms with which the Abyssinians are troubled, and for which they employ the *kosso*, is the tape-worm. The accuracy of this latter statement has been proved by Dr. Hodgkin (*Medical Times*, October 26, 1844, p. 74), who gave oil of turpentine to an Abyssinian in the service of Dr. Beke, and thereby expelled a *Tænia solium*—the same kind of tape-worm which prevails in England, and which is understood to prevail at the Cape of Good Hope.

In the *Encyclopédie Méthodique* (*Botanique*, Supplem. torn. ii. p. 423, 1811), Lamarck has described the *Cusso d'Abyssinie*, which he named after Dr. C. G. Hagen, a professor at Königsberg, the *Hagenia Abyssinica*. He says the tree was discovered by Brown—but I presume that this is a typographical error, and that for "Brown" should be read "Bruce;" for the figures of the plant given by Lamarck (pl. 311) are obviously copied from those of Bruce, though he does not refer to this distinguished traveller as his authority.

It is remarkable that Lamarck's proposed generic name (*Hagenia*) has been applied by the late Professor Eschweiler (*Systema Lichenum*, 1824) to a proposed genus of lichens usually included in that of *Parmelia*; and by Möneh (*Methodus*, 1794) to a caryophyllaceous plant now regarded as a species of *Gypsophila*. Willdenow (*Species Plantarum*) and Sprengel (*Syst. Veget.* ii. 220, 1825) have each adopted Lamarck's name (*Hagenia Abyssinica*) for *kosso*.

Dr. Brayer, a French physician, who resided for a considerable time at Constantinople, and who had witnessed the valuable anthelmintic properties of *kosso*, and had himself successfully employed this remedy, sent, on his return to Paris, in 1823, some fragments of the male flowers to the late celebrated Prussian Botanist, Kunth, who ascertained that the plant which yielded them formed a new genus, near to, but distinct from, that of *Agrimonia*.³ To this genus Kunth gave the name of *Brayera*, after the physician who sent him the flowers, and the species he called *B. anthelmintica*. This generic name has been adopted in the systematic works both of De Candolle (*Prodromus*, vol. ii. p. 588) and Endlicher (*Genera Plantarum*, 6395). Kunth does not appear to have been aware either of Bruce's notice of *kosso*, or that Lamarck had previously given to this genus the name of *Hagenia*; otherwise, doubtless, he would have referred to them, and have adopted this designation. Dr. Brayer published a little pamphlet (*Notice sur une Nouvelle Plante de la Famille des Rosarées*, Paris, 1823, 8 pages) on this medicine, but which I have not been able to get a sight of; the reply to my inquiries for it at Paris being that it was out of print. According to the information furnished by Dr. Brayer, it appears that *kosso* is carried by the caravans to Egypt, and from thence finds its way to Constantinople.⁴

¹ [From a paper by Dr. Pereira, published in the *Pharmaceutical Journal*, July 1850, vol. x. p. 15.—Ed.]

² *De Abyssinorum rebus*, lib. i. cap. 2. v. 6. Lyon, 1645.

³ In the first volume, p. 470, of the *Mémoires de l'Académie Royale de Médecine*, it is erroneously stated that *kosso* is the *Agrimonia orientalis* of Tournefort, who saw it in Abyssinia. Now, in the first place, Tournefort never was in Abyssinia; and secondly, the *A. orientalis* (*A. repens*, Linn.) is a creeping herb, whereas the *kosso* is a large tree!

⁴ In the *Journ. de Pharmacie*, t. ix. p. 160, 1823, is an *Extrait du Bulletin de la Société Philomatique*, 1822, containing a notice of Dr. Bayer's observations respecting *kosso*, and of Kunth's determination of the plant.

The identity of the genera *Hagenia* and *Brayera* was first recognized by Fresenius (*Museum Senkenbergianum*, vol. ii. p. 162, 1837).

In 1839, Buchner (*Repertorium*, 2te Reihe, Bd. xviii. S. 367) gave a notice of three Abyssinian remedies which he had received from Engelmann. One of these was the *kosso* (called *koso*), which was stated to be the flowers of the *Brayera* [*Brayera*] *anthelmintica*. In 1840, Wittstein (*Buchner's Repertorium*, 2te Reihe, Bd. xxi. p. 24) published an analysis of *kosso*, which he calls *Brayera anthelmintica*.

Riecke's *Die neuern Arzneimittel*, published in 1840, contains a notice of the *Brayera anthelmintica* by Dr. Plieninger, who obtained his information respecting it from some missionaries, returned from Abyssinia; and the same notice includes some botanical and pharmacological account of this medicine by Dr. Kurr.

In 1841, Dr. Aubert, who had spent some time in Abyssinia, read a *Mémoire sur les Substances Anthelmintiques usitées en Abyssinie*, before the Académie Royale de Médecine, Paris, and which was published in the Memoirs of the Academy for that year. His account of the anthelmintic virtues of the *kosso* confirms the statements of preceding writers. A very interesting Report on his memoir was drawn up by Mérat, and published in the *Bulletin de l'Académie Royale de Médecine*, tom. vi. p. 492, 1840-41.

M. Rochet d'Hericourt, in his *Second Voyage sur les Deux Rives de la Mer Rouge dans le Pays des Adels et le Royaume de Choa*, published at Paris in 1846, gives a very brief notice of the *kosso*, with a lithograph of the flowers and leaves. This traveller is the present holder of the entire European stock (about 1400 lbs.) of *kosso*.

Drs. R. Quartin-Dillon and A. Petit, the naturalists of the French Expedition to Abyssinia in the years 1838-43, collected the *kosso*; of which a botanical description has been published by A. Richard, in the *Tentamen Floræ Abyssinicae*, which forms the fourth volume of the *Voyage en Abyssinie*, edited by M. Th. Lefebvre. The forty-eighth plate of the "Botanique" of this "Voyage" contains an excellent figure of the plant, with dissections of the flower.

NATIVE NAMES.—My friend Dr. Beke, the well-known Abyssinian traveller, has given the following note respecting the native names for this remedy: "The tree, of the flowers of which you have a sample, is called in the Amharic language *kosso*,¹ and in that of Tigre, *hhäbbe*.² In the Gafat language it is styled *kossish*, and in the Gonga, *kosbo*;³ in the Agau of Waag, *sika*; in that of Agau-mider, *shinei*; and in Falasha, *sakikana*; whilst in Galla, its name is *bêti*. In the countries farther to the south, it has other names,⁴ which, however, I have not collected in my vocabularies of the languages of those countries. But it is best known in Abyssinia and Europe by its Amharic designation, *kosso*." Dr. Beke farther observes that "the tape-worm, for which the *kosso* flowers are a remedy, is known in the languages of Amhara and Tigre by the same names respectively as the medicine itself, viz. *kosso* and *hhäbbe*. So, too, in the Gafat and Gonga, in which respectively both are called *kossish* and *kösbo*. In the Waag-Agau, likewise, the name *sika* is the same for both; but in the dialect of Agau-mider, the worm is called *two*, and, in the Falasha, *saka*; whilst in the Galla, it is *minui*."

BOTANY.—The first accurate botanical description of the flowers of *kosso* was given by Kunth, whose account has been adopted in De Candolle's *Prodromus*. Kunth, however, was acquainted with the male flowers only. The most recent systematic notice of the genus *Brayera* is that of Endlicher, which I shall adopt.

BRAYERA, Kunth.

BRAYERA, Kunth, in *Brayer Notice*, in Svo. 1824, Paris; *Dict. Class. Hist. Nat.* vol. ii. p. 501, cum icone. DC. *Prodr.* ii. 588. Meisner, *Gen.* 103 (73). Fresenius in *Mus. Senkerb.* ii. 162; Endlicher, *Gen. Plant.* p. 1248, 6395; *HAGENIA*, Lamarck, *Encycl. Méth. Bot.* Suppl. t. ii. p. 423; Willdenow, *Sp. Pl.* ii. 331. *CUSO*, *BANKESIA*, Bruce's *Travels*, vol. v. p. 73.

Calyx, with the tube bibracteolate at the base, turbinate; throat constricted internally by a membranous ring; limb 10-partite; the segments in two series, the five outer ones much larger, oblong-lanceolate, obtuse, reticulate-veined, stellately patent, the five inner ones alternate, smaller, spatulate. *Petals* 5, inserted in the throat of the calyx, small, linear. *Stamens* from 15 to 20, inserted along with the petals. *Filaments* free, unequal in length. *Anthers* bilocular, dehiscing longitudinally. *Carpella* 2, placed at the bottom of the calyx, free, unilocular, containing one or two pendulous ovules. *Styles* terminal, exerted from the throat of the calyx, thickened upwards. *Stigmas* subpetalate-dilated, crenato-oblong.

NAT. ORD.—ROSACEÆ, Jussieu. De Candolle places it in Tribe v. *Dryadeæ*. Endlicher, in his suborder, *Spiræacæ*.

¹ This word is variously spelt by different writers, *cusso*, *cosso*, *cousso*, *coso*, *koso*, *kosso*, and *kousso*. Dr. Aubert says it should be pronounced (in French) *cousso*.

² According to Dr. Plieninger, who obtained his information from the Abyssinian missionaries, the Tigre name is *hepak*. Wittstein writes it *hab*.

³ Written *cobo* by some persons.

⁴ Dr. Brayer gives *cotz* or *cabotz*, as vernacular names; according to Dr. Aubert (*Bullet. de l'Acad. Royale*, these names are erroneous.)

BRAYERA ANTHELMINTICA, Kunth, l. c.; DC. l. c.; A. Richard, Tentamen Floræ Abyssinice
Hagenia, Abyssinica, Lamarek, l. c.; *Cusso, Bankesia Abyssinica*, Bruce, l. c.

Fig. 360.



Brayera anthelmintica, Kunth.

A. Flowering branch.

B. Bunch of female flowers.

C. Flower seen laterally.

D. Female flower.

a, b, c, d, e, the five outer segments of the calyx.

The only species.

An Abyssinian tree, twenty feet high. Branches round, rusty, tomentose villose, marked by the annular cicatrices of the fallen leaves. Leaves crowded, alternate, interruptedly imparipinnate and sheathing at the base. Leaflets oblong, or elliptical lanceolate, acute, serrate, villose at the margin and on the nerves of the under surface. Stipules adnate to the petiole, which is dilated at the base and amplexicaul. Flowers diœcious, small, greenish, and becoming purple; repeatedly dichotomous; the pedicels with an ovate bract at the base.

The so-called male flowers may be regarded as hermaphrodite flowers, inasmuch as the carpels are well developed. The female flowers are somewhat different in their structure. The outer segments of the calyx are much more developed than in the female flowers, and are four or five times larger than those of the inner row, and are placed somewhat below them; the petals are entirely wanting; the stamina are rudimentary and sterile.

The ripe fruits are unknown.

The tree grows in Tigre, Agame, and Shoa; it is cultivated everywhere.

Dr. Beke writes that the tree is "found throughout the entire table-land of North-eastern Abyssinia, but appears to require an elevation of upwards of six thousand (perhaps of seven thousand) feet for its growth. Where I found it most luxuriant was in the vicinity of the source of the River Abai (Bruce's Nile), at an elevation of close upon nine thousand feet. Tigre,

the northern portion of Abyssinia, being, on the whole, of lower elevation than the rest of that country, the tree is only found there in a few places."

Bruce describes the flowers as being of a greenish colour, tinged with purple; and, when fully blown, of a deep red or purple. The petals, he says, are white.

PREPARATION.—Mr. Johnston states that the kosso is gathered for medicinal purposes before the seeds are quite ripe, whilst still a number of florets remain unchanged. The bunches are suspended in the sun to dry, and if not required for immediate use, are deposited in a jar.

PHARMACOGRAPHY.—I have seen only one package of kosso (*flores brayeræ anthelminticæ*); this was kindly opened in my presence by M. Simond, of the firm of Caylits, Simond, and Co, the agents of M. Rochet d'Hericourt. It was a deal-box, containing about 30 lbs. of the dried flowers, wrapped up in a large skin of red leather. On removing the lid of the box and untying the leather package, the fragment or balsamic odour of the dried flowers was very powerful. It appeared to me to be somewhat similar to the combined odour of tea, hops, and senna-leaves. The flowers had apparently undergone no preparation beyond that of desiccation. The bunches of flowers were perfect and unbroken, though of course compressed. The general colour of the dried mass was greenish-yellow; but when the flowers were more closely examined, the edges of the petals were seen to have a reddish or purplish colour.

The taste of the dried flowers is at first not very marked, but after a few minutes a feeble senna-like, acrid, unpleasant taste becomes perceptible. By soaking the dried flowers in water they may be unfolded sufficiently to determine their botanical characters, which have been already described. When submitted to microscopic examination the hairs are perceived to be simple lymphatic hairs, tapering at the distal extremity.

In Abyssinia, two sorts of kosso are distinguished, viz., 1st, the red kosso produced by the female flowers; 2dly, the male flowers, known as *kosso-esels*. In commerce, the two sorts are always mixed together.

ADULTERATION.—Considering the enormous price (about £1 15s. per ounce) at which kosso has hitherto been sold in Paris, and the very limited quantity originally supplied by M. Rochet d'Hericourt, it cannot be surprising that the article should be extensively adulterated. Indeed, I have been assured on credible authority, that the powder now selling as "kousso" is, in fact, the powder of pomegranate bark; and that legal proceedings have been commenced in Paris to put a stop to the fraud, which is well calculated to injure the reputation of the genuine Abyssinian remedy.

I have no doubt that the microscope would readily detect the substitution; but the surest way of obtaining the genuine article is to purchase the dried flowers in the entire state, not in the form of powder.

CHEMISTRY.—The flowers of the Brayera (*i. e. kosso*) have been analyzed by Wittstein (*ante cit.*) and by Martin (*Journ. de Chimie Méd. t. vi. 2nde sér. p. 579, 1840*). The following are the results obtained:—

Wittstein's Analysis.		Martin's Analysis.	
Fatty oil . . .	1.44	Starch.	
Chlorophylle }	2.02	Saccharine matter.	
Wax	6.25	Vegetable extractive matter.	
Bitter acrid resin	0.77	Green very odorous resin.	
Tasteless resin	1.08	Crystalline substance called <i>kwoseine</i> .	
Sugar	7.22		
Gum	8.94		
Tannin striking a green colour with iron	15.46		
Tannin striking a blue colour with iron	40.97		
Vegetable fibre	15.71		
Ashes	99.86		
[Loss	00.14]		
	100.00		

The *ashes* consist of potash, magnesia, lime, oxide of iron, sulphuric and phosphoric acids, chlorine, and silica.

With regard to the two kinds of *tannin*, Wittstein observes that, as far as he knows, this is the first instance recorded of a plant containing simultaneously two kinds of tannin, striking, the one a blue, the other a green colour with the salts of iron.

Although it is not improbable that the anthelmintic property of *kosso* may in part depend on tannin (since the pomegranate bark, which contains this principle in abundance, is, like *kosso*, also an anthelmintic), yet what may be termed the peculiar property of the *kosso* probably resides chiefly in the bitter acrid resin. This is soluble in alcohol and in ether, and appears to be a neutral body, manifesting neither distinct alkaline nor acid properties.

The crystalline principle to which Martin has given the barbarous name of *kwoseine* (from *kwoso*, the supposed name for *kosso*), is described as consisting of white silky crystals, having a styptic taste, and as being soluble in alcohol and sulphuric ether. They are said to redden litmus paper, and to dissolve, without undergoing decomposition, in sulphuric, nitric, and muriatic acids.

By boiling the dried plant in water a fragrant odour is evolved. No doubt this as well as the odour of the dried plant itself depends on the presence of a *volatile oil*, of which, however, no mention is made in Wittstein's analysis, the oil being present in too small a quantity to admit of its collection when small quantities of the flowers are operated on.

It is not improbable that the anthelmintic properties may in part depend on this oil, for Schimper states that, in Abyssinia, the plant is considered to have lost its anthelmintic powers in the third year after its collection. In Europe, however, it retains its powers for a longer period (on account of the cooler climate?); for the flowers which have been used for all the recent experiments have been collected more than four years, and we are told, in the shop-bill of a Parisian pharmacien, that they may be kept for an indefinite period.

An infusion of a decoction of kosso strikes a dark-green olive tint with a solution of the sesquichloride of iron.

MEDICINAL PROPERTIES.—Neither botanical characters, sensible qualities, nor chemical composition, would have induced us to suspect that *kosso* possesses the valuable anthelmintic properties which experience has shown that it does.

The general and prevailing quality of the Rosaceæ is astringency, dependent on the presence of tannic and gallic acids. This is observed in the flowers (e.g. rose petals), as well as in other parts of the plants. In this quality *kosso* agrees with its congeners. But it can scarcely be on this that its vermifuge property solely depends; otherwise rose petals, or any other equally powerful astringent, would be as effective in expelling worms as these Abyssinian flowers. But in Rosaceæ, as in many other families of the vegetable kingdom, anomalies exist—and to this head we must for the present be content to refer *kosso*.

Our confidence in the anthelmintic properties of *kosso*, rests, then, on experience only; and the evidence on this point is very strong. All modern travellers in Abyssinia are agreed on the great success of the remedy on the natives of that country; and the experience of physicians in France, England, Germany, and Switzerland, confirms the favourable reports made by those who have seen the *kosso* used in its native country.

In Paris, it has been employed with great success by Chomel and Sandras (*Ann. de Thérap. pour* 1847), as well as by numerous other distinguished physicians. In London, our experience of it is much more limited; but the successful results of its use in King's College Hospital, in the hands of Drs. Budd and Todd (*Lancet*, March 16, April 20, and May 25, 1850), and of Dr. Gull (*Lancet*, May 25), in Guy's Hospital, confirm the favourable reports of its efficacy which had reached this country from abroad.

The physiological effects of *kosso* are not in general very great. Sometimes it excites a slight sensation of heat, nausea, or even vomiting, creates thirst, and frequently, perhaps usually, a gentle action on the bowels. But the latter is commonly so slight that, in a considerable number of cases, it is necessary to follow its administration by a mild purgative. It is obvious, therefore, that the efficacy of *kosso* as an anthelmintic does not depend on its purgative or evacuant influence, but on its poisonous or toxic action on the worm; in fact, it is a true *vermicide*. In one case, that of a woman in France, it brought away ten worms, of which one only manifested evidences of vitality, and that for a few minutes only.

Kosso appears to be an effective anthelmintic in both kinds of tape-worm, viz. the *Tania solium*, and *Bothriocephalus latus*. In most of the reported successful cases, the *Tania solium* was the parasite expelled; but in one of Chomel's cases, the worm which was evacuated was the *Bothriocephalus latus*, and I am informed that *kosso* has proved most effectual in Switzerland, where, as is well known, the *Bothriocephalus* is the prevailing tape-worm.

The dealers in *kosso* assert that one dose will, in every case, effect the radical cure of tape-worm. But this must be obviously an error. Even supposing that it invariably destroys all the worms in the alimentary canal at the time of its exhibition, it can in no way prevent their recurrence, provided the patient retains his predisposition (which there is no reason to suppose is affected by the *kosso*), and is subjected to the same influence. It certainly does not radically cure the Abyssinians, since, as several writers tell us, they resort to this remedy monthly. Schimper, the Governor of Adoa, says it does not completely expel the *tenia*, or at least rarely does so. But, he adds, that possibly in Europeans, in whom the verminous disposition is not so pronounced as in the Abyssinians, it may perhaps act in a more complete manner. In the Abyssinians this verminous disposition is innate, and is dependent, he adds, on the regimen which they adopt.

Hitherto, the great drawback to the use of *kosso* has been the difficulty of procuring the remedy, and its enormous cost. At the time when it could be purchased in Paris, its price was £1 15s. per. oz., or 17s. 6d. per dose. M. Rochet d'Hericourt, the sole holder of the medicine at the present time, refuses to sell any quantity less than his entire stock, at the rate of one guinea per ounce! His nephew tells me that his uncle possesses 1400 lbs. of it, which, at one guinea per ounce, will cost 22,400 guineas!!! The impossibility of effecting a sale on such terms will, I doubt not, ultimately compel the holder to reduce his demands to something approaching to reason. It does not appear that the remedy is very costly in Abyssinia. Schimper, writing from Adoa, in Abyssinia, says that it is found in commerce at a very low price. At Yangaroo (commonly called Zingaro), the sovereign has the exclusive use of it, his subjects being prohibited from employing it; but in other parts free trade in *kosso* is permitted. Con-

sidering the frequency and rapidity of our communications with Egypt (to which place, according to Dr. Brayer, *kosso* is conveyed by caravans), no difficulty, I apprehend, will be experienced in obtaining an abundant supply of it. Its present price is a virtual prohibition of its use.

The flavour, though not very strong, is by no means agreeable; and is sufficiently powerful in some patients to create disgust and excite vomiting. In one case, under M. Chomel (*Ann. de Thérap. pour* 1847), the whole of the remedy was rejected by vomiting.

No ill effects have resulted from its use in this country; nor have I met with any statement of its injurious action, except in Mr. Johnston's *Travels in Southern Abyssinia* (vol. ii. p. 272, 1844), where it is stated that its "operation is speedy and effectual; and to judge by the prostration of strength it occasioned in my servants when they employed this medicine, it must be dreadfully severe. I can answer for this, that it occasions frequent miscarriages, often fatal to the mother; and even men have been known, after a large dose, to have died the same day from its consequences. I am, therefore, surprised at the noise this remedy has occasioned the last few years in Europe, as if it promised to be a valuable addition to our *Materia Medica*. This, I conceive, can never be, for no civilized stomach could bear the bulk of the drug necessary to produce its effects. Even in Abyssinia it is but barely tolerated, and let another remedy equally efficacious for dislodging tape-worm be introduced into that country, and the use of *kosso* will be soon abandoned. In fact, several other vegetable productions are now employed to escape the punishment of a dose of this violent cathartic."

ADMINISTRATION.—Both Bruce (*op. ante cit.*) and Schimper (Bourchardat, *Annuaire de Thérap. pour* 1849, p. 257) tell us that the Abyssinians take a handful of the dried flowers as a dose. In Paris, the dose has varied from four to six drachms. In general, however, half an ounce (troy weight) is considered a dose for an adult.

For different ages the doses are thus adjusted:—

Adults	1 dose = 240 grs. (half an ounce.)
Children of from 7 to 12 years	$\frac{3}{4}$ of a dose = 160 grs.
" 3 to 7 "	$\frac{1}{2}$ of a dose = 120 grs.
" not exceeding 3 "	$\frac{1}{4}$ of a dose = 80 grs.

The *kosso* should be taken in the morning, fasting. The only preparation necessary is, that the last meal of the previous evening should be slight. The evacuation of the bowels by a mild purgative or a lavement is also desirable.

The mode of administering the remedy is as follows: The powdered flowers are to be mixed with lukewarm water (for an adult about ten ounces), and allowed to infuse for a quarter of an hour. A little lemon-juice is then to be swallowed, and, the infusion being stirred up, the whole is taken, liquid and powder, at two or three draughts, at short intervals, being washed down by cold water and lemon-juice. To promote the operation, tea (without sugar or milk) may be taken. In three or four hours, if the remedy has not operated, a dose of castor-oil or a saline purgative should be administered.

2. **CHERRY-TREE GUM.**—From the stems of the *Cherry* (*Cerasus avium*), *Plum* (*Prunus domestica*), and some other rosaceous trees, there exudes a mucilaginous liquor, which concretes into tears, forming the *gummi nostras*, *cherry-tree gum* (*gunmi cerasi*), *plum-tree gum* (*gunmi pruni*). It may be employed in medicine as a substitute for tragacanth gum. It consists of two gummy principles: one called *arabine* (see *gum Arabic*), soluble in cold water; the other termed *prunin* or *cerasin*, insoluble in cold, but soluble in hot water.

3. **ALCHEMILLA ARVENSIS**, *Field Ladies' Mantle*, or *Parsley Pierl*, is a small, indigenous, herbaceous plant, with green flowers. It belongs to *Tetrandria Monogynia*, in the sexual system. It is astringent (owing to tannic acid), and, perhaps, slightly mucilaginous. It was formerly eaten raw or pickled, and thought serviceable in cases of gravel or stone; hence it was called *break-stone*. Proul¹ regards it as a diuretic, and as producing, in particular states of the system, a large secretion of lithic acid. A strong infusion of it, taken frequently, sometimes gives great relief, he says, in the less severe cases of the phosphatic or earthy deposit, where the source of irritation is chiefly confined to the urinary organs, and where the constitution is sound, and the strength not remarkably reduced.

4. **BEDEGUAR.**—On various species of *Rosa*, perhaps most frequently on *R. rubiginosa*, the *Sweetbrier* or *Eglantier*, is found a remarkable gall, called the *Sweetbrier Sponge* (*Bedeguar* seu *Fungus Rosarum*). Pliny

Fig. 361.



Bedeguar or Sweetbrier Sponge.

¹ *Inq. into the Nat. and Treat. of Diabetes*, &c. 2d ed. pp. 149 and 185.

terms it, in one place,¹ a little ball (*pilula*), in another,² a sponglet (*spongiola*). It is produced by the puncture of several insect species, viz. *Cynips Rosæ* and *Brandtii* (both of which are elaborately described by Ratzeburg³) and a species of *Mesoleptus*. Other species (as those of *Diplolepis* and *Pteromalus*) are also found in these galls; but they are probably parasites, and not the true inhabitants. The Bedeguar is usually rounded, but of variable size, sometimes being an inch, or an inch and a half or more in diameter. Externally, it looks shaggy, or like a ball of moss, being covered with moss-like branching fibres, which are at first green, but become afterwards purple and red. The nucleus is composed principally of cellular tissue, with woody fibre; and where the fibres are attached, bundles of spiral vessels are observed. Internally, there are numerous shells, in each of which is the larva of an insect; if opened about August or September, maggots (larvæ) are usually found. It is inodorous, or nearly so; its taste is slightly astringent, and it colours the saliva brownish. It has not been analyzed, but is suspected to contain tannic and gallic acids. Dried and powdered, it was formerly given in doses of from ten to forty grains, as a diuretic and lithontriptic. More recently it has been recommended as an anthelmintic, and as a remedy against toothache. Pliny says the ashes, mixed with honey, were used as a liniment for baldness. In another place, he speaks of the fungus being mixed with bear's grease, for the same purpose.

ORDER LXV. LEGUMINOSÆ, *Jussieu*.—THE BEAN TRIBE.

Fabacæ, *Lindley*.

CHARACTERS.—Calyx of 5 (rarely of 4) sepals, more or less united at the base, and, therefore, 5-toothed, 5-cleft, or 5-partite; sepals unequal, in some cases almost equally coherent, in others conerected into 2 lips; the upper consisting of 2 sepals, which are either free at the apex, or united; the lower of 3 sepals generally distinct at the apex. *Petals* 5, or, by abortion, 4, 3, 2, 1, or none; generally unequal, inserted usually into the base of the calyx, rarely on the torus; in general, variously imbricated, rarely valved, almost always free, sometimes united into a gamopetalous corolla. [In the sub-order *Papilionacæ*, the petals form a butterfly-shaped or *papilionaceous* corolla, composed of a large upper petal, called *vexillum* or *standard*, two lateral ones, termed *alæ* or *wings*, and an inferior keel-shaped one denominated *carina* or *keel*, and which is, in fact, composed of two petals adherent by their margin.] *Stamens* inserted with the petals, generally double the number of the latter, rarely triple or quadruple, or fewer; altogether free, or the filaments variously connected, being monadelphous, with the tube entire or cleft above, or diadelphous 9 and 1, or 5 and 5, very rarely triadelphous; *anthers* two-celled. *Carpel* generally 1, the others being abortive; or 2 to 5. *Ovary* oblong or ovate, sessile or stipitate, free, or very rarely adnate by the stipe to the calyx. *Style* 1, filiform, arising from the upper suture; *stigma* terminal or lateral. *Legumes* 2-valved, membranous, cori-

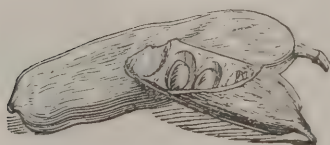
Fig. 362.



Papilionaceous Flowers.

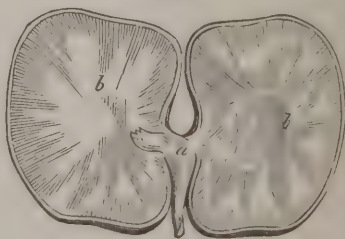
ing from the upper suture; *stigma* terminal or lateral. *Legumes* 2-valved, membranous, cori-

Fig. 363.



Legumes of Ceratonia Siliqua.

Fig. 364.



Common Garden Bean.

a. Plumule. b. Cotyledons or seed lobes.
c. Radicle bent on the cotyledons (*curvembria*.)

¹ *Hist. Nat. lib. xxi. cap. 73, ed. Valp.*

² *Mediz. Zoolog. Bd. ii. S. 146, et seq.*

² *Ibid. lib. xxv. cap. 6.*

aceous, rarely fleshy or drupaceous, dehiscent or indehiscent, 1-celled; or by the folding in of one of the sutures, longitudinally 2 celled; or by isthmi or articulations, transversely many-celled. *Seeds* 2, or many, or by abortion (?) solitary, affixed to the upper suture, inserted alternately into each valve, frequently oval or reniform; *funiculus* various, rarely expanded into an arillus; *testa* smooth, frequently very much so, and stony; *endopleura* often tumid, simulating albumen. *Embryo* sometimes straight [*rectembria*], or curved [*curvembria*], the radicle being inflexed on the commissure of the lobes (*homotropal* or *pleurorhizous*); in either case the radicle directed towards the hilum; *cotyledons* foliaceous or fleshy; the first exsert, the latter germinating within the spermoderm, under ground.—*Trees, shrubs, or herbs* with alternate, bistipulate, simple or variously-compounded *leaves*.—(Condensed from De Candolle, with additions within the square brackets.)

PROPERTIES.—Exceedingly variable. Similar organs of different, though often closely-allied species are frequently found to elaborate most dissimilar principles; and, of course, the dietetical, medicinal, or poisonous properties vary in a corresponding manner.—For details, consult Dierbach, *Abhandl. üb. d. Arzneikräfte der Pflanzen*; and De Candolle, *Essai sur les Propr. Méd.*

Sub-order I. PAPILIONACEÆ.

270. MYROSPERMUM (*Myroxylon*), *Species incertæ* (*Peruiferum*), De Cand., E.—

THE QUINQUINO.

Myroxylon peruiferum, Linn.

Sex. Syst. Decandria, Monogynia.

(*Balsamum ex inciso trunco fusum*, L.—Fluid balsamic exudation, E.—*Balsamum*, D.)

(*Balsamum Peruvianum*, U. S.)

HISTORY.—The balsam of Peru was first mentioned by Nicholas Monardes, under the name of *balsamum*.¹ No accurate notions of the tree yielding it were entertained until 1781, when Mutis sent some branches of it to the younger Linnæus.² Ruiz³ afterwards described it.

BOTANY. **Gen. Char.**—*Calyx* campanulate, 5-toothed, persistent. *Petals* 5, the upper one largest. *Stamens* 10, free. *Ovary* stipitate, oblong, membranous, with 2 to 6 ovules; *style* towards the apex, filiform, lateral. *Legume*, with stalk naked at the base but winged superiorly, samaroidial [*legumen samaroidium*, De Cand.], indehiscent, 1-celled, 1- or 2-seeded, laterally pointletted by the style. *Seed* besmeared with balsamic juice; *cotyledons* thick, plane. (De Cand.)

Sp. Char.—*Leaves* coriaceous, persistent, smooth as well as the branches. Wing of the *legume* very thick, not veined. *Style* deciduous. (De Cand.)

A branching, elegant tree. *Bark* thick, very resinous. *Leaves* pinnated, alternate; leaflets 2 to 5 pairs, alternate ovate-lanceolate. *Racemes* axillary. *Petals* white. *Legume* somewhat coriaceous, straw-coloured, about four inches long including the stalk. *Seeds* reniform.

Hab.—Peru, New Granada, Columbia, and Mexico. Grows in low, warm, and sunny situations.—Flowers from August to October.

COLLECTION.—Monardes⁴ says that there are two modes of procuring the balsam; viz. incision into the bark of the tree, and coction of the branches and trunk in water. The first method yields a *white liquid balsam*, the second a *blackish-red liquid*. Ruiz³ states that the white liquid balsam is preserved for years in bottles, in the fluid state; but when depogited in mats or calabashes, which is commonly done in Carthagea, and in the mountains of Tolu, it after some time condenses and hardens into resin, and is then denominated *dry white balsam*, or *balsam of Tolu*; while the extract made by boiling the bark in water is blackish, remains liquid, and is known by the name of *black Peruvian balsam*. There is, however, obviously some confusion in this statement; and several reasons have led pharmacologists to doubt whether the black balsam of the shops is obtained by coction. Ruiz does not speak from his own observation, but on the authority of Valmont de

¹ Clusius, *Exot.* 303.

² Lambert, *Illustr. of the Genus Cinchona*, p. 92.

³ *Op. cit.* p. 95.

⁴ Murray, *App. Med.* vi. 111.

⁵ *Op. cit.* p. 302.

Bomare. Lastly, Hernandez¹ says the balsam obtained by incision is yellowish-black (*e fulco in nigrum*). Professor Guibourt has received, from M. Bazire, balsam of Peru, which he obtained in great abundance on the coast of Son Sonate, called the Balsam Coast, in the state of San-Salvador (the republic of Guatimala) by incisions in the stem of a *Myrospermum*, whose fruit is very different to that of *M. Toluiferum*.² Th. Martius³ suggests that the black balsam of Peru is procured by a kind of *destillatio per descensum*; but the absence of pyrogenous products in the balsam seems to me to be opposed to this opinion.

[M. Victor le Nouvel, who has been engaged in collecting this balsam since 1836, gives the following as the process used by the Indians to obtain it: An incision is made into the tree, of about two or three inches broad, and three to four inches long. They raise the bark from the wood, and apply cotton rags to it; a fire being lighted round the tree to liquefy the balsam. Fresh incisions are made higher and higher up the tree, till the cotton rags are quite saturated. It takes from ten to twelve days to effect this. The rags are next boiled; and when the liquor is cold, the balsam collects below. Peruvian balsam always contains a good deal of water, sometimes as much as 60 per cent.⁴—ED.]

COMMERCE.—Balsam of Peru is imported in pear-shaped earthenware pots and in tin canisters, from Valparaiso, Islay, Lima, Truxillo, Callao, Iquique, and Belize. The duty (1s. per lb.) paid on it during six years was as follows:—⁵

In 1831	1893 lbs.	In 1837	1331 lbs.
1835	213	1838	1798
1836	180	1839	825

DESCRIPTION.—Balsam of Peru (*balsamum peruvianum*), called also *black* or *liquid balsam of Peru* (*balsamum peruvianum nigrum*), is a transparent deep reddish-brown or black liquid, which has the consistence of treacle, a powerful but agreeable odour, somewhat similar to that of vanilla and benzoin, and which is increased by dropping the balsam on a redhot coal, and a warm, acrid, bitter taste. It is inflammable, and burns with a fuliginous flame. It is soluble in alcohol; the solution, however, is not clear, but lets fall after some time a deposit. To boiling water it yields its acid, usually stated to be the benzoic, but, according to Frémy and others, it appears to be the cinnamonic acid. Its sp. gr. is 1.150 to 1.160.

I have received from Professor Guibourt another balsamic substance, under the name of *balsam of Peru, in cocoa-nut shells* (*baume du Pérou en cocos*). The shell has the size and shape of a small lemon. The contained balsam is of a deep brown colour, and has an odour very similar to that of balsam of Tolu. Guibourt says: "It appears to be formed of two kinds of matter; one more fluid, another more solid, grumous, and as it were crystalline. Its taste is mild and sweetish. It has a strong agreeable odour, between that of Tolu and soft liquidambar, but distinct from both."

The *white balsam of Peru* (*balsamum peruvianum album*) of Martius, and other pharmacologists, is said, by Guibourt,⁶ to be the *solid balsam of liquidambar* already described.

ADULTERATION.—Balsam of Peru is said to be subject to adulteration; and the formulæ given by Gray⁷ for *making* as well as for *reducing* (*i. e.* adulterating) it, lend support to this opinion. The demand for the balsam being small, the supply quite equal to or even exceeding the demand, and the price being moderate, are circumstances which appear to remove all motive for adulteration, which I do not think is at present practised in this country. The characters to be attended to in judging of its genuineness are, the purity of its odour, its complete solubility in, or miscibility with, alcohol (by which the absence of fixed oil is shown), and its undergoing no diminution of volume when mixed with water (by which the absence

¹ *Rep. Med. Nov. Hisp. Thes.* p. 51, 1651.

² *Pharmakogn.*

³ *Trade List.*

⁴ *Suppl. to the Pharm.*

⁵ *Hist. des Drog.* ii. 3me éd. 590.

⁶ *Pharm. Journ.* vol. xi. p. 260.

⁷ *Op. cit.*

of alcohol is proved). A sign of its purity is, that 1000 parts of it should saturate 75 parts of pure crystallized carbonate of potash.¹

COMPOSITION.—Balsam of Peru has been elaborately investigated by several chemists, and the results obtained are somewhat curious. In 1806 it was examined by Lichtenberg,² Stolze,³ in 1825, published an analysis of it. Richter,⁴ Plantamour,⁵ and Frémy,⁶ have since examined the nature of its constituents.

Stolze's Analysis.

Brown slightly soluble resin	2.4
Brown resin	20.7
Oil of balsam of Peru [cinnaméine]	69.0
Benzoic [cinnamonic] acid	6.4
Extractive	0.6
Loss and moisture	0.9
Balsam of Peru	100.0

Frémy's Analysis.

1. An oily matter [cinnaméine], frequently containing, in solution, a crystalline substance (*metacinnaméine*; *hydruret of cinnamyle*).
2. Cinnamonic acid.
3. One or more resins (*hydrates of cinnaméine*).

Balsam of Peru.

1. OIL OF BALSAM OF PERU; *Cinnaméine* of Frémy.—If an alcoholic solution of potash be added to an alcoholic solution of balsam of Peru, a compound of resin and potash (*resinate of potash*) is precipitated, while cinnanonate of potash and cinnaméine are left in solution. On the addition of water the latter separates, and floats on the surface. It is to be purified by solution in petroleum. Cinnaméine is a reddish-brown, acid, odourless, oily fluid, heavier than water, soluble in alcohol and ether, insoluble in water, and inflammable. Its composition, according to Frémy, is (taking the average of five experiments), carbon 79.0, hydrogen 6.26, oxygen 14.74. His formula for it, which, however, scarcely accords with this statement, is $C^{78}H^{26}O^8$ [$C^{144}H^{65}O^{20}$, Liebig]. Caustic potash effects a change on it analogous to saponification, and converts it into two equivalents of cinnamonic acid (equal to $C^{38}H^{14}O^6$) and a light oily fluid, which Frémy calls *peruvine*, whose composition is, carbon 79.6, hydrogen 9.3, oxygen 11.1, or $C^{18}H^{12}O^2$ [$C^{36}H^{25}O_4$, Liebig]. Cinnaméine frequently (but not invariably) contains in solution a crystalline substance, termed *metacinnaméine*, whose composition is, carbon 81.9, hydrogen 6.0, oxygen 12.1; its formula being $C^{18}H^{12}O^2$, so that it is isomeric with *hydruret of cinnamyle*. Richter asserts that oil of balsam of Peru is composed of two distinct oils—one, called *myrospermine*, which is soluble in alcohol; the other, termed *myroxiline*, insoluble in alcohol. What relation these oils bear to cinnaméine and peruvine has not yet been made out.

2. CINNAMONIC ACID; *Cinnamic Acid*.—This constituent has usually been mistaken for benzoic acid. It is obviously formed in the balsam by the oxidation of the hydruret of cinnamyle, just as hydruret of benzule is transformed into benzoic acid. In those balsams of Peru which contain no *metacinnaméine*, this principle has been entirely converted into cinnamonic acid.

3. RESIN OF BALSAM OF PERU; *Hydrate of Cinnaméine*. The quantity of resin in balsam of Peru augments daily. It is formed by the union of cinnaméine with the elements of water; for its composition is carbon 71.82, hydrogen 6.78, oxygen 21.40; or $C^{54}H^{30}O^{12}$. So that this resin consists of one equivalent of cinnaméine and four equivalents of water. It is not, however, formed at once, but it gradually undergoes different degrees of viscosity. Soft resin differs from the hard only in its elements of water. Sulphuric acid converts cinnaméine into resin.

Such are the general results of Frémy's analysis; but the correctness of some of them may be fairly called in question. His formulæ do not always agree with his experimental results (see cinnaméine). Plantamour denies the accuracy of several of Frémy's statements.

PHYSIOLOGICAL EFFECTS.—Stimulant, slightly tonic, expectorant, detergent, and epulotic. Its action is similar to other balsamic substances, and is closely allied to that of storax and benzoin. Topically, it operates as a stimulant and mild acid; and when applied to foul indolent ulcers, often cleanses them, and promotes their cicatrization. Taken internally, in full doses, it creates thirst, and quickens the pulse. Its stimulant influence is directed to the secreting organs, especially the bronchial mucous membrane. It is devoid of the powerful influence over the urinary organs possessed by copaiva and the turpentine, and its tonic powers are not equal to those of myrrh.

USES.—Its supposed efficacy in curing external ulcers and healing wounds has led to its use in internal diseases, formerly apprehended to depend on ulceration, as in pulmonary affections supposed to be, or which really were, phthisis. But the

¹ Th. Martins, *Pharmakogn.*

² *Journ. de Chim. Méd.* i. 139.

³ *Ibid.* S. 225, and *für* 1839. S. 601.

⁴ *Comptes-Rendus*, 1838, Sec. Sem. No. 20; and *Ann. de Chim. et de Phys.* t. lxx. p. 160.

⁵ *Berlin. Jahrb.* 1806, S. 22.

⁶ *Pharm. Cent.-Blatt für* 1838, S. 346.

observations of Dr. Fothergill,¹ in part, led to the discontinuance of the indiscriminate use of balsams and other heating substances in these cases. Yet it proves serviceable in some old asthmatic cases, chronic pulmonary catarrhs, winter coughs, &c. It seems to be principally adapted to *old-standing chronic affections of the mucous membranes* (especially the bronchial mucous membrane), particularly in persons of a cold and torpid habit. Its stimulant influence is calculated only to aggravate acute cases.

Many other uses of balsam of Peru are now obsolete: as its employment in lead colic, as recommended by Sydenham; in gonorrhœa and leucorrhœa, by Hoffman;² in convulsions from repressed perspiration, by Kirkland;³ and externally and internally in traumatic tetanus, by Dr. Kollock.⁴ It is said to be now and then used in chronic rheumatism. The beneficial effects ascribed by Trousseau and Pidoux to the balsams in chronic laryngitis have been before referred to.

As a topical remedy, balsam of Peru is occasionally employed. It is applied either alone, or in the form of ointment, to indolent, ill-conditioned ulcers; it cleanses them, promotes healthy granulation, and assists cicatrization. I have used it in some obstinate ulcerations about the nose. Dr. Ainslie⁵ speaks very highly of its powers of arresting the progress of sphacelous and phagedenic affections, so common and destructive in India. He recommends lint, soaked in the balsam, to be applied night and morning. In offensive discharges from the ear, it is now and then dropped in after syringing. It is a constituent of some lip-salves. It was formerly esteemed as a vulnerary against wounds of the tendons and nerves. It is used by perfumers for *scenting*, and in the manufacture of *fumigating pastiles*.

ADMINISTRATION.—Dose, fʒss to fʒj. It may be taken on sugar, or made into pills with some absorbent powder, or diffused through water by means of sugar, honey, gum, or yolk of egg.

271. MYROSPERMUM TOLUIFERUM, Richard, E.—THE BALSAM OF TOLU-TREE.

Toluifera Balsamum, Miller, D.

Sex. Syst. Decandria, Monogynia.

(Concrete balsamic exudation, L.—Balsamum ex incisio trunco fusum concretum, D.)

(Balsamum Tolutanum, U. S.)

HISTORY.—The earliest notice of balsam of Tolu is that of Monardes.⁶ He tells us that the balsam had been recently imported.

BOTANY. Gen. Char.—See *Myrospermum peruiferum*.

Sp. Char.—Branches and leaves smooth. *Leaflets* oblong, acuminate, equilateral, rounded at the base. (De Cand.)

The tree which yields the balsam of Tolu was formerly called *Toluifera Balsamum*. But Richard having carefully investigated the characters of the genus *Toluifera*, found that, with the exception of those of the fruit, which Miller had imperfectly described, they were identical with those of the genus now called *Myrospermum*; and as Ruiz states that the balsams of Peru and Tolu are both obtained from one tree, the *Myrospermum peruiferum* has been adopted by several writers, and by the London College, as the source of both balsams.

Richard⁷ found specimens of the trees yielding these balsams in Humboldt's herbarium; and though he at first mistook them for the same species, he has subsequently recognized them to be different. He therefore made a distinct species of the tree yielding the balsam of Tolu, and it is now called *Myrospermum toluiferum*. It differs from *M. peruiferum* in its having thin, membranous, obovate leaflets, which are lengthened and acuminate at their summits. Moreover, the terminal leaflet is larger than the lateral ones.

Hab.—Mountains of Tolu, Turbaco, and on the banks of the Magdalena, between Garapatas and Monpox.

PRODUCTION.—Balsam of Tolu is procured by making incisions into the bark of the tree, and receiving the liquid balsam in vessels made of a black wax. It is

¹ *Med. Obs. and Inq.* vol. iv. p. 231.

² *Treat. on Childbed Fever*, p. 31, 1774.

³ *Mat. Ind.* i. 65 and 406.

⁴ *Ann. Scien. Nat.* t. ii. p. 168.

⁵ *Opera omni. Suppl.* p. 736. Genev. 1754.

⁶ *Thacher's Dispensatory*.

⁷ *Clusius, Exot.* 304.

afterwards transferred into proper vessels. It only exudes from the tree during the heat of the day.¹

COMMERCE.—Balsam of Tolu is sometimes brought direct from Carthagera, Santa Martha, and Savanilla; more commonly, however, it comes by way of New York or Jamaica. It is usually imported in cylindrical tin canisters; now and then in earthen pots or jars; still more rarely in small calabashes.

DESCRIPTION.—Balsam of Tolu (*balsamum tolutanum* vel *de Tolu*), when first brought over, is generally soft and tenacious, but by age becomes hard and brittle, somewhat similar to resin, and has a granular or somewhat crystalline appearance. Formerly, it was imported in this hardened state, but is now usually met with in the soft state. It is transparent, has a reddish or yellowish-brown colour, a most fragrant odour, though less powerful than that of storax or Peruvian balsam, and a pleasant sweetish taste. It softens under the teeth; when heated, it readily melts, takes fire, and burns with an agreeable odour. It is very soluble in alcohol and ether, and gives out its acid to water. The soft balsam contains more oil but less acid than the dry balsam, the acid and the resin being formed at the expense of the oil. Balsam of Tolu hardens or resinifies with much more facility than balsam of Peru.

Balsam of Tolu in calabashes (*balsamum tolutanum in cucurbitis parvis*, Dale) occurs in calabashes (the fruit of *Crescentia Cujete*, according to Sloane²) about the size of an orange; the large aperture by which the balsam has been introduced being closed with the rachis of the fruit of *Zea Mays*.

COMPOSITION.—According to Frémy³ the composition of balsam of Tolu is similar to that of balsam of Peru, its constituents being *cinnaméine*, *cinnamonic acid*, and *resin*. They differ, according to the same chemist, from those of balsam of Peru by the greater facility with which they become resinified.

RESIN OF BALSAM OF TOLU.—Is essentially the same as that of balsam of Peru, and, like it, also forms a fine red colour with sulphuric acid; but it is less fusible than the resin of the last-mentioned balsam. It consists of carbon 70.8, hydrogen 6.1, and oxygen 23.1; so that it contains a larger proportion of the elements of water.

PHYSIOLOGICAL EFFECTS AND USES.—The effects of balsam of Tolu are similar to those of balsam of Peru, and the other balsamic substances. It is employed as a stimulating expectorant in chronic bronchial affections, unaccompanied with inflammatory action. It is, however, more frequently used as an agreeable flavouring adjunct to pectoral mixtures. The vapour of the ethereal solution of the balsam has been inhaled in chronic affections with benefit. *Tolu lozenges* form a popular and pleasant remedy for appeasing troublesome cough. The balsam is sometimes employed by confectioners to flavour *sweetmeats*, as marmalade. It is also used in *perfumery*; and is a constituent of some *fumigating pastiles* already described.

ADMINISTRATION.—The dose of the balsam is from grs. x. to ʒss. It may be taken in the form of an *emulsion*, made with gum or sugar. It is a constituent of the *compound tincture of benzoin*, L. D., before described.

1. TINCTURA TOLUTANA, L. E. D. [U. S.]; *Tincture of Tolu*.—(Balsam of Tolu ʒij ʒiiss, in coarse powder, *E*) (ʒiij, *U. S.*); Rectified Spirit Oij [Oj *D.*]; (Alcohol Oij, *U. S.*) Digest [with a gentle heat, *E. D.*] until the balsam is dissolved, and filter, *L.* [Let it stand until the sediment subsides, then decant the clear tincture, *D.*]—A stimulating expectorant, principally used as a flavouring adjunct to other pectorals. Its use is, of course, objectionable in inflammatory cases. Dose, fʒss to fʒij. When mixed with water the resin is precipitated; hence it should be rubbed with mucilage, or some viscid liquor, before adding the water, to keep the resinous precipitate in suspension.

2. SYRUPUS TOLUTANUS, L. E. D. [U. S.]; *Syrup of Tolu*; *Balsamic Syrup*.—(Balsam of Tolu ʒx; Boiling Distilled Water Oj; Sugar lbiss. Boil the balsam

¹ Monardes, *op. cit.* 304.

² *Ann. de Chim. et de Phys.* t. lxx. p. 201.

³ *Hist. Nat. Jamaica*, ii. 174.

in the water for half an hour, in a vessel lightly covered, frequently stirring, and strain the cooled liquor; then add the Sugar, and dissolve it, *L.*—Simple Syrup, lbs. ij; Tincture of Tolu ℥j. When the syrup has been recently prepared, and has not altogether cooled, add the tincture of Tolu by degrees, agitating briskly, *L.* Balsam of Tolu ℥j; Distilled Water Oj; Refined Sugar, in powder, as much as is sufficient. Boil the balsam in the water for half an hour, in a lightly covered vessel, occasionally stirring, and strain the liquor when cold; then, having added to it twice its weight of sugar, dissolve with the aid of a steam or water heat, *D.*)—[The *U. S. Pharm.* directs, Tincture of Tolu f℥iss; Water Oj; Sugar lbiss. Mix the tincture with the sugar in coarse powder; expose the mixture in a shallow dish to a gentle heat, until the alcohol has evaporated; then pour the water upon it in a covered vessel; heat gradually till the Sugar is dissolved, and strain.] Employed as an agreeable flavouring adjunct to pectoral mixtures. Dose, f℥j. to f℥iv.

272. CYTISUS SCOPARIUS, *Decand. L. E.*—COMMON BROOM.

Spartium scoparium, *Linn. D.*

Sez. Syst. Diadelphia, *Decandria.*

Cacumen recens et exsiccatum, *L.*—Tops, *E.*—Cacumina, *D.*

HISTORY.—It is uncertain who first mentioned this plant. The σπάριον of Dioscorides¹ is *Spartium junceum* or *Spanish Broom*.² The *Genista* of Pliny³ was probably the same plant, though the Roman historian was himself doubtful whether this plant was identical with that of the Greeks. Sprengel⁴ considers that Theophrastus was undoubtedly acquainted with Common Broom.

BOTANY. Gen. Char.—*Calyx* 2-lipped; the upper lip generally entire, the lower one somewhat 3-toothed. *Vexillum* ovate, large; *keel* very obtuse, inclosing the stamens and pistils. *Stamens* monadelphous. *Legume* plano-compressed, many-seeded, without glands.—*Shrubs.* *Leaves* trifoliate. (*De Cand.*)

Sp. Char.—*Branches* angular, smoothish. *Leaves* trifoliate, stalked. *Tops* simple. *Leaflets* oblong. *Flowers* axillary, stalked, solitary. *Legumes* hairy at the margin. (*De Cand.*)

A *shrub*, 3 to 6 feet high. *Branches* long, straight, and green. *Leaves* deciduous; upper ones generally simple. *Flowers* large, bright yellow; *keel* broad; *vexillum* and *alæ* much spreading. *Legumes* large, dark-brown, containing 15 or 16 seeds.

Hab.—Indigenous; growing on dry hills and bushy places. Flowers in June.

DESCRIPTION.—Broom-tops (*scoparium*; *cacumina scoparii*) have a bitter, nauseous taste, and, if fresh, a remarkable odour when bruised.

COMPOSITION.—The flowers of broom contain, according to Cadet de Gassicourt,⁵ concrete volatile oil, fatty matter, wax, chlorophylle, yellow colouring matter, tannin, a sweet substance, mucilage, osmazome, albumen, and woody fibre. The ashes amounted to 5.75 per cent., and contained 29 per cent. of carbonate of potash, besides chloride of potassium, sulphate of potash, chloride of calcium, nitrate, phosphate, and sulphate of lime, carbonates of lime, magnesia, and iron, and silica.—*Salt of broom*, or *sal genistæ*, is obtained by burning the whole plant. It contains a large portion of carbonate of potash. Hill⁶ says that a pound of the green twigs, with the leaves and flowers, yields a drachm and a half of this salt.

[Dr. Stenhouse has separated, as he believes, the diuretic principle of the broom, and has tried its effects upon dogs and rabbits. When quite pure it is a yellow substance, and crystallizes in needles. This chemist found that the narcotic principle of broom is a volatile base, represented by the formula C¹⁵H¹³N. It is not quite so poisonous as conia or nicotine, but it produced in small doses a species of violent intoxication, followed by a profound slumber, from which the animal cannot be

¹ Lib. iv. cap. 158.

² *Hist. Nat. lib. xxiv. cap. 40, ed. Valp.*

³ *Journ. de Pharm. x. 448.*

⁴ Smith, *Prodr. Fl. Græc.* ii. 53.

⁵ *Hist. Rei Herb.* i. 80.

⁶ *Hist. of the Mat. Med.* 397.

roused for a long time without great difficulty. To this base he gives the name of *Spartine*.

The term *Scoparine* is applied by Dr. Stenhouse to a green gelatinous matter, which is formed in a concentrated watery extract of broom, after it has stood for one or two days in a cold place. Scoparine has no taste, and does not appear to be at all poisonous or injurious. The dose of scoparine required to produce a decidedly diuretic effect is five grains, repeated three times at intervals of three hours. *Spartine* and its salts have an intensely bitter taste. The carbazotate cannot be distinguished from carbazotate of potash.—ED.]

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—In some parts of Europe broom is employed as winter food for sheep; and Withering says that it prevents the disease called rot, and is salutary in dropsy, to which sheep are liable. According to Loudon, it is apt to produce disease of the urinary organs, to prevent which a plentiful use of water is recommended.

β. On Man.—In large doses, broom-tops are an emetic and purgative. In small doses they are diuretic and mildly laxative. As a diuretic they have been celebrated by Mead and Cullen.—“Though very little in use,” says Dr. Cullen,¹ “I have inserted this in my catalogue from my own experience of it. I found it first in use among our common people; but I have since prescribed it to some of my patients in the manner following: I order half an ounce of fresh broom-tops to be boiled in a pound of water till one-half of this is consumed; and of this decoction I give two table-spoonfuls every hour, till it operates by stool and urine; and by repeating this exhibition every day, some dropsies have been cured.” Having very frequently employed broom in dropsies, I can add my testimony to its powerful effects as a diuretic. I cannot call to mind a single case in which it has failed to act on the kidneys. In some cases it produced a most marked and beneficial effect on the dropsical effusion. According to my experience, it is more certain than any other diuretic in dropsies. Dr. Pearson² terms broom a *tonico-diuretic*; and says it improves the appetite, and invigorates the whole system.

USES.—It has been principally or solely employed in dropsies, and, as already mentioned, sometimes with great benefit. Of course, its chance of cure depends on the nature of the cause of the dropsical effusion. In acute inflammatory cases, as well as in diseased kidney, its use might be objectionable. It is said also not to be adapted to thoracic dropsy, especially when combined with pulmonary congestion, or any degree of inflammatory affection of the chest.

ADMINISTRATION.—Broom-tops are usually given in the form of *infusion* or *decoction*. The *seeds*, which keep much better than the tops, and on that account have an advantage over the latter, may be used in the form of powder, in doses of grs. x to grs. xv in mint water or cold ginger tea; or in the form of tincture (see *Spartium junceum*). To promote the operation of broom, diluents should be freely used.

DECOCTUM SCOPARII COMPOSITUM, L.; Decoctum Scoparii, E. D.; Decoction of Broom.—(Broom-tops, Juniper Berries, Dandelion Root, of each $\mathfrak{z}\text{ss}$; Distilled Water Oiss. Boil down to a pint, and strain, *L.*—Broom-tops and Juniper-tops, of each $\mathfrak{z}\text{ss}$; Bitartrate of Potash $\mathfrak{z}\text{iiss}$; Water Oiss. Boil them down together to a pint, and then strain, *E.*—Broom-tops dried $\mathfrak{z}\text{ss}$; Water Oss. Boil for ten minutes in a covered vessel, and strain. The product should measure about $\mathfrak{z}\text{viii}$, *D.*)—Diuretic and laxative.—Dose, $\mathfrak{f}\mathfrak{z}\mathfrak{j}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{j}$.

¹ *Mat. Med.*

² *Observ. on Broom-seed, 1635.*

273. GLYCYRRHIZA GLABRA, Linn. L. E. D.—COMMON LIQUORICE.

Sex. Syst. Diadelphia, Decandria.

(*Radix recens et exsiccata*, L.—Root; Extract of the root, E.—*Radix*, D.)

HISTORY.—The γλυκύριζα of Hippocrates, and that of Dioscorides,¹ are doubtless identical; the latter is supposed by Sprengel² and others to be our *Glycyrrhiza glabra*; by Diebach³ to be *G. glandulifera*, but by Dr. Sibthorp⁴ it is said to be the *G. echinata*, which is now termed in Greece γλυκόριζα. *Glycyrrhiza glabra* is called, in the *Pharmacopœia Græca*, γλυκύριζα.

BOTANY. **Gen. Char.**—*Calyx* naked, tubular, 5-cleft, 2-lipped; with the two upper lobes united more than the others. *Vexillum* ovate-lanceolate, straight; keel 2-parted or 2-petalous, straight, acute. *Stamens* diadelphous. *Style* filiform. *Legume* ovate or oblong, compressed, 1-celled, 1- to 4-seeded.—Perennial herbs with extremely sweet roots. *Leaves* unequally pinnated. *Racemes* axillary. *Flowers* blue, violet, or white. (De Cand.)

Sp. Char.—*Leaflets* ovate, slightly retuse, viscid beneath. *Stipules* 0. *Spikes* pedunculated [i. e. *racemes*], shorter than the leaves. *Flowers* distant. *Legumes* smooth, 3- or 4-seeded. (De Cand.)

Stem erect, smooth, 4 or 5 feet high. *Leaflets* yellowish-green. *Flowers* papilionaceous, bluish or purplish.

Hab.—South of Europe. Cultivated at Mitcham in Surrey, and at other places, for medicinal use.

DESCRIPTION.—The underground stem is denominated *liquorice-root* (*radix glycyrrhizæ seu liquiritiæ vel liquoricæ*) or *stick liquorice*. It is in long cylindrical pieces, about the thickness of the finger. Externally it is grayish brown, internally yellow. Its odour is rather sickly and earthy; its taste remarkably sweet.

COMMERCE.—Liquorice-root (*G. glabra*) was analyzed by Robiquet in 1809.⁵ Trommsdorff⁶ analyzed the root of *G. echinata*. The constituents of the fresh root of *G. glabra* are, according to Robiquet, *glycyrrhizin*, *starch*, *asparagin*, *resinous oil*, *albumen*, *woody fibre*, and *salts* (phosphate and malate of lime and magnesia).

1. **GLYCYRRHIZIN** (*Glycion* or *Liquorice Sugar*).—Belongs to the uncrystallizable sugars which are not susceptible of vinous fermentation. It is characterized by its affinity for acids, with which it unites to form compounds which are very slightly soluble only in water. It is yellow and transparent, and has the sweet taste of the root. It is soluble in both water and alcohol. Acids precipitate it from its solution. It combines also with bases, as well as with salts. It causes precipitates with many metallic solutions.

2. **RESINOUS OIL.**—To this constituent, liquorice root owes the slight degree of acidity which it possesses.

PHYSIOLOGICAL EFFECTS.—Liquorice root and its extract are emollient, demulcent, and nutritive.

USES.—Employed as an emollient and demulcent in catarrhal affections of the mucous membranes. It is also used as a flavouring adjunct to other medicines. Its powder is employed in the preparation of pills, either to give them a proper consistence, or to prevent their adhesion.

ADMINISTRATION.—For medicinal use the root should be *decorticated*, as the epidermis possesses a slight degree of acidity.

1. **EXTRACTUM GLYCYRRHIZÆ**, L. E. D. [U. S.]; *Extract of Liquorice*.—(Of recent liquorice-root, bruised, ℥iiss; Boiling Distilled Water, Cong. ij; macerate 24 hours, then boil to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence, L. [Liquorice-root in thin slices, dried and reduced to coarse powder, ℥bj; Distilled Water Oij; proceed as for extract of Gentian, D.] [Cut

¹ Lib. iii. cap. 7.

² *Arzneim. d. Hippokrates*.

³ *Ann. de Chim.* lxxii. 143.

⁴ *Hist. Rei Herb.* i.

⁵ *Prodr. Fl. Græcæ*, ii. 77.

⁶ *Guélini, Handb. d. Chem.* ii. 1261.

liquorice-root into small chips, dry it thoroughly with a gentle heat, reduce it to a moderately fine powder, and proceed as for extract of Gentian, *E.*])—Extract of liquorice is extensively imported under the name of *liquorice juice*, or, according to the countries from where it is brought, *Spanish* or *Italian juice*. *Solazzi juice* is most esteemed. The Spanish extract is prepared in Catalonia from *G. glabra*; while the Italian extract is obtained in Calabria from *G. echinata*.¹ In 1839, there were imported 4,059 cwt. of foreign extract of liquorice, the duty on which is £3 15s. per cwt. It comes in cylindrical or flattened rolls of five or six inches long, and about one inch in diameter, and enveloped in bay leaves. When pure, it is black and dry, with a glossy fracture and a sweetish taste; and is completely soluble in water. As met with in commerce, however, it is rarely pure. Neumann² obtained 460 parts of watery extract from 480 of Spanish liquorice. It contains the soluble principles of the root, with some copper scraped off the boiler by the spatula employed to stir the extract during its preparation. Fée says that four ounces of this extract yield two drachms and a half of metallic copper; but there must be some great mistake in this statement. If the foreign extract be dissolved in water, and the solution filtered and inspissated, we obtain *refined liquorice*. But I am informed that the *pipe refined liquorice* of the shops is a very adulterated article. The *Pontefract lozenges* are made of refined liquorice, and are much esteemed. Another preparation has been recently introduced under the name of *quintessence of liquorice*. Extract of liquorice is dissolved slowly in the mouth, to appease tickling cough. It is a very agreeable flavouring adjunct to other medicines. As it easily becomes soft by warmth it does not answer well as a pill-basis.

2. *TROCHISCI GLYCYRRHIZÆ, E.*; *Liquorice Lozenges*.—(Extract of Liquorice Gum Arabic, of each 3vj; Pure Sugar lb. i. Dissolve them in a sufficiency of boiling water; and then concentrate the solution over the vapour-bath to a proper consistence for making lozenges.)—Employed in tickling cough and irritation of the fauces.

(3. *TROCHISCI GLYCYRRHIZÆ ET OPII, U. S.* *Troches of Liquorice and Opium*.—(Take of Opium in powder, half an ounce; Liquorice in powder, Sugar in powder, Gum Arabic in powder, each ten ounces; Oil of Anise two fluidrachms. Mix the powders intimately; then add the Oil of Anise, and with water form them into a mass, to be divided into troches, each weighing six grains.)—Employed in coughs and catarrhs, under the name of Wistar's Cough Lozenges. Two or three are the dose.)

274. ASTRAGALUS, *De Candolle*.—MILK VETCH.

A. verus, Olivier, *L.*—*A. Gummifer*, and probably *A. verus*, and other species, *E.*—*A. gummifer* (Labillardière), *D.*

Sex. Syst. Diadelphia, Decandria.

(*Succus e cortice exudatus ære induratus, L.*—Gummy exudation, *E. D.*)

[*Tragacanthus, U. S.*]

HISTORY.—Dr. Sibthorp³ states that the *τραγάχαλθα* of Dioscorides⁴ is the *Astragalus aristatus*, which in the Peloponnesus is still called *τραγάχαλθα*, and whose gum is annually sent to Italy.

BOTANY. Gen. Char.—*Calyx* 5-toothed. *Corolla* with an obtuse keel. *Stamens* diadelphous. *Legume* 2-celled, or half 2-celled, by the lower [dorsal] suture being turned inwards.—*Herbs* or *shrubs*. (*De Cand.*)

Species 1. A. VERUS, L. E.—*Flowers* axillary, in clusters of 2 to 5 sessile. *Calyx* tomentose, obtusely 5-toothed. *Leaflets* 8 to 9 pairs, linear, hispid. (*De Cand.*)—A small shrub. *Branches* covered with imbricated scales and spines, the remains of former petioles. *Flowers* yellow, papilionaceous. *Persia*. According

¹ Fée, *Cours d'Hist. Nat.* ii. 24.

² *Prodr. Fl. Græc.* ii. 90.

³ *Works*, by Lewis, p. 425.

⁴ *Lib.* iii. cap. 23.

to Olivier, the Tragacanth of Asia Minor, Armenia, and Northern Persia, forming the greater part of that of Europe, is yielded by this species.

2. *A. GUMMIFER*, D.—*Flowers* 3 to 5 axillary, sessile. *Calyx* 5-cleft, together with the legumes woolly. *Leaflets* 4 to 6 pairs, oblong-linear, smooth. (De Cand.)—Lebanon. According to Labillardière this species yields Tragacanth. (De Cand.) Dr. Lindley¹ received this plant from Mr. Brant, English Consul at Erzeroum, as the tragacanth plant of Koordistan, which yields the white or best kind of tragacanth.

3. *A. CRETICUS*.—*Flowers* axillary, sessile, clustered. *Calyx* 5-partite with feathery, setaceous lobes rather longer than the corolla. *Leaflets* 5 to 8 pairs, oblong, acute, tomentose. (De Cand.)—Mount Ida, in Crete, where it yields Tragacanth, according to Tournefort.

Fig. 365.

*Astragalus creticus*.

4. *A. STROBILIFERUS*, Lindley.—*Flowers* capitate in an ovate, sessile, axillary strobile.—*Bracts* imbricated, pointletted, tomentose. *Calyx* feathery, 5-cleft. Segments of the *Corolla* equal. *Leaflets* 3-paired, woolly, oval, awned at the apex, narrow at the base (Lindley).—Koordistan.—This plant was sent by Mr. Brant as the "shrub from which the red or inferior species of gum tragacanth is produced."²

PRODUCTION.—Tragacanth is a natural exudation from the stem of the before-mentioned plants. The cause of the exudation of this as of other gums is thus explained by De Candolle.³ The gummy matter resides in the bark and albumen; it is the nutritive juice of the plant; and its escape, therefore, is analogous to hemorrhage in animals: hence plants in which it spontaneously occurs are always in a sickly state. The mechanical cause of the expulsion of this juice is dependent on the unequal hygrometric properties of the different parts of the stem. The wood absorbs more moisture from the air than the bark, and hence it swells more. In consequence of its enlargement, it distends the bark, which, by the internal pressure of the wood, gives way, and the gummy matter escapes. This explanation is quite in conformity with facts mentioned by Labillardière—that tragacanth flows only in abundance during the night, and a little after sunrise. A cloudy night, or a heavy dew, is, he thinks, necessary for its production; for the shepherds of Lebanon only go in search of this substance when the mountain has been covered during the night with thick clouds.

DESCRIPTION.—Tragacanth (*gummi tragacantha*) is frequently called in the shops *gum dragon*. It is white, yellowish, or yellowish-brown, hard, tough, odourless, tasteless, swelling considerably in water, and forming a thick, tenacious mucilage. Two kinds of it are known.

1. **Flaky Tragacanth:** *Smyrna Tragacanth* (Martius): *Tragacanth of the Astragalus verus?*—This is the tragacanth usually found in English commerce. It occurs in moderately large, broad, thin pieces, marked with arched or concentric elevations.

2. **Vermiform Tragacanth:** *Morea Tragacanth* (Martius); *Tragacanth of the Astragalus creticus?*—This variety is rarely met with in this country, but is common on the continent. It occurs in small, twisted, filiform, spiral pieces. There is more starch in it than in the first variety.

COMMERCE.—Tragacanth is imported in cases and chests from Smyrna and other ports of the Levant. In 1836, duty (6s. per cwt.) was paid on 87 cwt.

COMPOSITION.—The ultimate analysis of tragacanth has been made by Hermann and by Guerin-Varry.⁴

¹ *Botanical Register*, May 1840.

² *Phys. Veg.* t. i.

³ *Ibid.* Miscellaneous Notices, p. 28.

⁴ *Journ. de Chim. Méd.* vii. 742.

Hermann's Analysis.

	Atoms.	Eq. Wt.	Per Cent.
Carbon	10	60	40.50
Hydrogen	10	10	6.61
Oxygen	10	80	52.89
Tragacanth gum	1	150	100.00

Guerin-Varry's Analysis.

Soluble part.	Insoluble ditto.
42.01	35.79
6.42	7.11
54.47	57.10
103.00	100.00

In 1805, Vauquelin¹ made an examination of the *proximate* constituents of tragacanth. In 1815, Bucholz², and in 1831 Guerin-Varry,³ published proximate analyses of this gum.

Bucholz's Analysis.

Common gum	57
Bassorin	43
Gum Tragacanth	100

Guerin-Varry's Analysis.

Arabin	53.30
Bassorin and starch	33.10
Water	11.10
Ashes	2.50
Gum Tragacanth	100.00

1. **TRAGACANTHIN.**—*Adragantin*; *Soluble gum* or *Arabin* of Tragacanth.—The soluble gum of tragacanth is usually regarded as similar to gum Arabic, and hence it is called arabine; but is distinguished by silicate of potash and perchloride of iron producing no change in it, and by a peculiar appearance of the precipitate produced with alcohol (the precipitate is flocculent, and collects in a simple opaque and mucous mass).—In common with arabine, it produces precipitates with diacetate of lead, protochloride of tin, and protonitrate of mercury. Oxalate of ammonia detects in it a calcareous salt.

2. **BASSORIN.** *Insoluble gum of Tragacanth.*—The insoluble part of gum tragacanth is similar to that of gum Bassora, and hence it is called *Bassorin*. It swells up in water.

3. **STARCH.**—Starch globules may be detected in the bassorin (when swollen up by water) both by the microscope and by iodine.

According to Guibourt,⁴ tragacanth contains neither arabin nor bassorin, but is essentially formed by an organized gelatiniform matter, very different to gum Arabic, both in its physical and its chemical properties, and which swells and divides in water, so as in part to pass through a filter. The insoluble part of tragacanth is, according to the same authority, a mixture of starch and lignin, which has nothing in common with bassorin. De Candolle suggests that the insolubility and swelling of tragacanth in water, may arise from the gummy matter being contained in cells.

PHYSIOLOGICAL EFFECTS.—Like other gums, tragacanth is emollient, demulcent, and nutritive; but difficult of digestion.

USES.—Tragacanth, in powder, is used rather as a vehicle for active and heavy medicines (as calomel) than on account of its own proper effects. It is occasionally, however, taken as a sheathing or demulcent agent in irritation of the mucous membranes.

ADMINISTRATION.—Dose of the powder, ʒss to ʒij.

1. **PULVIS TRAGACANTHÆ COMPOSITUS**, L. E.; *Compound Powder of Tragacanth.*—(Tragacanth bruised; Gum Arabic bruised; Starch, of each ʒiiss; Pure Sugar ʒij. Rub the Starch and Sugar together to powder, then having added the Tragacanth and Gum Arabic, mix them together.)—Employed as a vehicle for the exhibition of active and heavy powders to children.—Dose for an adult, ʒss to ʒj.

2. **MUCILAGO TRAGACANTHÆ**, E.—(Tragacanth ʒij; Boiling Water fʒix. “Macerate for twenty-four hours, then triturate to dissolve the gum, and express through linen or calico,” E.)—Employed in making pills and lozenges; also to suspend heavy powders, as the metallic oxides, in water. It has also been recommended as an application to burns.

¹ *Ann. de Chim.* liv. 312.

² *Op. supra cit.*

³ *Gmelin, Handb. d. Chem.* ii. 779.

⁴ *Hist. des Drog.* ii. 477.

275. MUCUNA PRURIENS, De Candolle, L. E.—COMMON COW-HAGE, OR COW-ITCH.

Dolichos pruriens, Linn. D.—*Stizolobium pruriens*. Persoon.

Sex. Syst. Diadelphia, Decandria.

(Fructus pubes. L.—Hairs from the pod, E.—The hairy down of the pod, D.)

HISTORY.—One of the earliest writers who mention this plant is Ray.¹ It was long confounded with the *M. prurita*, Hooker.

BOTANY. **Gen. Char.**—*Calyx* campanulate, 2-lipped; the lower lip trifid, with acute segments, the middle one the longest; the upper lip broader, entire, obtuse. *Vexillum* ascending, shorter than the alæ and keel; *alæ* oblong, as long as the keel; *keel* oblong, straight, acute. *Stamens* diadelphous; *anthers* 10, of which 5 are oblong-linear, and 5 ovate, hirsute. *Legume* oblong, knotted, 2-valved, with cellular partitions. *Seeds* roundish, surrounded by a circularly linear hilum.—Twining herbs or shrubs. *Leaves* pinnately trifoliate. *Racemes* axillary. *Legumes* usually hispid and stinging, by the innumerable very brittle hairs which readily penetrate the skin. (De Cand.)

Sp. Char.—*Flowers* in racemes. *Legumes* stinging, with somewhat keeled valves. *Leaflets* hairy beneath, acuminate; the middle one rhomboidal, the lateral ones dilated externally. (De Cand.)—*Root* perennial. *Stem* herbaceous. *Flowers* with a disagreeable alliaceous odour; *vexillum* flesh-coloured; *alæ* purple or violet; *keel* greenish-white.

Hab.—West Indies.

MUCUNA PRURITA, Hooker.²—A native of the East Indies; has been usually confounded with the American *M. pruriens*; but is distinguished by its smaller leaves, its more obtuse (not acuminate) *leaflets*, the middle one being more truly rhomboidal; its *flowers* more constantly in threes, and by its *legumes* being greatly broader, compressed, free from any raised line on the back of the valve; whilst in the American *M. pruriens*, the pods are much narrower, terete, and keeled on the valves.

DESCRIPTION.—*Cowhage* or *Cow-itch* (*siliqua hirsuta*) is the legume of the *Mucuna pruriens* (*legumen mucunæ, stizolobii, vel dolichos prurientis*). It is of a brownish colour, is shaped like the letter \int , about four or five inches long, contains from four to six seeds, and is clothed with strong, brown, bristly, stinging hairs (*pubes leguminis; setæ siliquæ hirsutæ*), which, examined by the microscope, appear like porcupines' quills, but are slightly notched or serrated towards the point.

COMPOSITION.—The hairs contain tannic acid.³

PHYSIOLOGICAL EFFECTS.—A decoction of the root or of the legumes is said to be diuretic, and was formerly used in dropsy.⁴ The *setæ* applied to the skin produce intolerable itching, and, in some persons, pain, redness, swelling, and even an eruption. These effects, which are increased by rubbing, but diminished by the application of oil, are referable to the mechanical properties of the *setæ*.

USES.—The *setæ* have been celebrated for their anthelmintic properties. Their action is supposed to be mechanical; that is, they are supposed to pierce and torment intestinal worms, and thereby to oblige them to let go their hold. In support of this explanation, Mr. Chamberlaine⁵ tells us he sprinkled some of the hairs in a calabash full of very large round worms (*Ascaris lumbricoides*), and that in a little time the animals began to writhe and twist about, evincing thereby extreme torture. On examining them with a magnifying-glass, the hairs were found sticking loosely in various parts of their bodies. Their usual want of action on the intestines is ascribed to the mucous secretion which defends the subjacent membrane from injury. In one case diarrhœa followed the use of a very large dose of the electuary,

¹ *Hist. Plant.* i. 887.

² Martius, *Pharmakogn.*

³ *Pract. Treat. on Stizolobium, or Cowhage*, p. 57, 9th edit. 1804.

⁴ *Bot. Miscell.* ii. 348.

⁵ Browne, *Jamaica*, p. 291.

and in another instance enteritis came on, after taking this preparation once; but it is not certain that these were the consequences of the operation of the hairs.¹

Cowhage has been principally celebrated for expelling the large round worm (*Ascaris lumbricoides*), and the small thread-worm (*A. vermicularis*). It has not proved equally serviceable against the tape-worm (*Tænia solium*).

ADMINISTRATION.—The best mode of exhibiting the setæ is in treacle, syrup, or honey. The quantity of hairs should be sufficient to give the syrup, or treacle, the consistence of honey, or of an electuary; and of this mixture a teaspoonful may be given to children, and a tablespoonful to adults; this dose should be taken twice a day—namely, at going to bed, and in the morning an hour before breakfast. Chamberlaine says it usually operates more effectually where a gentle emetic has been premised. After continuing the electuary for three or four days, a brisk purgative of jalap, or senna, should be taken, which will in general bring away the worms.

276. PTEROCARPUS SANTALINUS, Linn. L. E.—THREE-LEAVED PTEROCARPUS.

Sex. Syst. Diadelphia, Decandria.
(Lignum, L.—Wood, E.)

HISTORY.—Avicenna² mentions red sandal wood (*sandalus rubens*). Garcias³ thinks the term *sandal* is a corruption of *chandama*, the name by which the wood is known in Timor.

BOTANY. Gen. Char.—*Sepals* 5, cohering to form a 5-toothed calyx. *Petals* 5, forming a papilionaceous corolla. *Stamens* 10; the *filaments* variously combined. *Legume* indehiscent, irregular, somewhat orbicular, surrounded by a wing, often varicose, 1-seeded. *Cotyledons* thick, curved; *radicle* somewhat inflexed at the base of the embryo.—Unarmed trees or shrubs. *Leaves* unequally pinnated. (De Cand.)

Sp. Char.—Arboreous. *Leaflets* 3 (rarely 4 or 5?), roundish, retuse, glabrous. *Racemes* axillary, simple or branched. *Petals* long-clawed, all waved or curled on the margins. *Stamens* combined into a sheath, split, down to the base on the upper side, and half-way down on the lower. *Legume* long-stalked, surrounded by a broad, membranous wing, obtuse at the base, 1- or rarely 2-seeded. (Wight and Arnott.)

A lofty tree. *Flowers* yellow, with red veins.

Hab.—Mountains of Coromandel and Ceylon.

DESCRIPTION.—Red Sandal or red Sander's wood (*lignum santali rubri; lignum santalinum rubrum*) is imported in roundish or somewhat angular billets, which are blackish externally, but of a blood-red internally. It is compact, heavy, of a fibrous texture, but is capable of taking a fine polish; almost tasteless, and inodorous, except when rubbed, when it emits a feeble smell. It scarcely communicates colour to water. Alcohol, as well as alkaline solutions, readily extract the colouring matter. The alkaline solution is violet-red, and forms a precipitate (*santalin*) on the addition of acids. The alcoholic solution produces precipitates with several metallic solutions; thus, violet with solutions of lead, scarlet with corrosive sublimate, and deep violet with sulphate of iron.

COMPOSITION.—Red Sandal wood was analyzed by Pelletier,⁴ who found in it a peculiar colouring matter, which he called *santalin* (about 16.75 per cent.), *extractive*, *gallic acid*, and *woody fibre*.

SANTALIN is dark-red, with a resinous appearance; almost insoluble in water, but soluble in alcohol, alkaline solutions, ether, acetic acid, and slightly so in some of the volatile oils (as the oils of lavender and rosemary). The effects produced on its alcoholic and alkaline solutions by salts, &c. are similar to those above mentioned on the tincture of the wood. The composition of santalin is, carbon 75.03, hydrogen 6.37, oxygen 18.6; or C¹⁶H⁸O³.

¹ Chamberlaine, *op. cit.* p. 65.

² Clusius, *Exot.* 173.

³ Canon. lib. ii. tract ii. cap. 656.

⁴ *Journ. Phys.* lxxix. 268.

USES.—It is employed in medicine as a colouring agent. (See *Tinctura Lavan-dulæ composita*.)

277. PTEROCARPUS (*Marsupium*, L. Roxb.), **ERINACEUS**, Lamarck, D. E.—**THE INDIAN KINO-TREE.**

Sex. Syst. Diadelphia, Decandria.

(Succus ex inciso cortice fusus, sole induratus, L.—Kino-Indicum; Concrete exudation of this and other undetermined genera and species, E.—Kino [plant yielding it unnamed], D.)

HISTORY.—In 1757, Dr. Fothergill¹ described an astringent gum, which he supposed (though on very loose evidence) to have been brought from the River Gambia; and hence he termed it *Gummi rubrum astringens gambiense*. In 1774, it was introduced into the Edinburgh Pharmacopœia as *Gummi kino*; and in 1787, into the London Pharmacopœia as *Resina kino*. It was described under this designation in the 3d edition of Lewis's *Exp. Hist. of the Mat. Med.*, by Dr. Aikin, in 1784. In 1794, Schenck² published an inaugural dissertation on it. I have not been able to ascertain why it was called kino; nor can the precise nature of the substance referred to be now ascertained. Several years since I accidentally found, in the warehouse of an old drug firm in London, a substance marked *Gummi rubrum astringens*, which I was told had formerly fetched a very high price. It has subsequently proved to be *Butea gum*. I was at first inclined to believe that it was the original astringent gum of Fothergill, and it has been described by Professor Guibourt³ as *gomme astringente de Gambie*. But a more attentive perusal of Dr. Fothergill's paper has led me to doubt their identity (see *Butea gum*). It is somewhat remarkable, however, that the Hindu name for *Butea gum* is *kueni* or *kuenee*, from which the European term *kino* may probably be derived.

BOTANY. Gen. Char.—See *Pterocarpus santalinus*.

Sp. Char.—*Stamens* monadelphous. *Leaflets* 5–7, alternate, elliptical, rather emarginate, leathery, smooth. *Branches* and *calyxes* smooth. *Panicle* terminal. *Pod* half-circular, oblique, smooth.—A tree.

Hab.—Malabar.

EXTRACTION OF THE JUICE OF PTEROCARPUS ERINACEUS.—"When an incision is made" in the trunk and branches of the tree, "the juice flows out, at first of an extremely pale-red colour, and in a very liquid state; but it soon coagulates, becoming of a deep blood-red hue, and so remarkably brittle, that its collection is attended with some difficulty."⁴

COMMERCE OF KINO.—Two substances are met with in English commerce under the name of kino—one called *Botany Bay Kino*, which is the inspissated juice of the *Eucalyptus resinifera* (before described), the other, apparently an extract, imported from Bombay and Tellicherry, and which may be termed *East Indian Kino*. The latter is presumed to be the substance referred to in the British pharmacopœias, as it is always regarded in commerce as *genuine gum kino*. It is imported in boxes, chiefly from Bombay or Tellicherry.

In my museum, I have several other substances, apparently extracts, which I have received as *kino*, mostly from Professor Guibourt, who has described several of them in his *Hist. des Drog.* ii. 428. One of these is, perhaps, *Jamaica kino*. A second I received as *Colombian kino*. A third I believe to be *foreign extract of rhatany*. I have never met with them in English commerce, and therefore think it needless to describe them.

DESCRIPTION.—*East Indian kino* (*kino indicum* seu *ostindicum*), sometimes called *Amboyna kino* (*kino amboinense*), and usually known in the shops as *gum kino* (*kino*, Ph. L. E. D.), occurs in small, angular, glistening fragments, the larger of which appears almost black, the smaller being reddish. When entire they are opaque, but in thin laminæ are transparent and ruby-red. They are brittle between

¹ *Med. Obs. and Inq.* i. 358, 4th edit. 1776.

² *Hist. des Drog.* ii. 428, 3me édit.

³ Gray, *Trav. in Western Africa*, in Stevenson and Churchill's *Med. Bot.*

⁴ *Coll. Diss. med. Marburg.* t. v.

the fingers, soften in the mouth, stick to the teeth, and colour the saliva red. They are inodorous, but have a very astringent taste. Both water and alcohol acquire, by digestion on kino, a deep red colour. The aqueous decoction becomes turbid on cooling. The mineral acids and solutions of gelatine, emetic tartar, acetate of lead, sesquichloride of iron, and nitrate of silver, produce precipitates with the watery infusion.

In the former edition of this work, the tree yielding East Indian kino was said to be unascertained; but that it was probably a native of the Malabar coast, for all the importations of East Indian kino which I had traced, were from Bombay or Tellicherry. An experienced East India broker had assured me it was the produce of the Malabar coast. As *pterocarpus erinaceus* is not known to grow in India, there is no ground for ascribing East Indian kino to that species. The London College have now made kino the produce of *Pterocarpus marsupium*, which, Dr. Roxburgh¹ says, yields an astringent inspissated juice exceedingly like Butea gum. I am indebted to Mr. Edward Solly for a sample of extract of *Pterocarpus marsupium*, which he received from Dr. Gibson. It is a dark red, tenacious, acidulous, moderately astringent substance. It differs, therefore, from the gummy resin which Dr. Roxburgh describes as being the product of this tree. This accurate naturalist describes it as being very brittle, and having a strong, but simply astringent taste; characters which apply to East Indian kino.

COMPOSITION.—East Indian kino was analyzed by Vauquelin,² who found its constituents to be as follows: *tannin* and *peculiar extractive* 75, *red gum* 24, *insoluble matter* 1. A. W. Buchner³ has subsequently shown that *catechine* is a constituent of kino. To this substance, which has been before noticed, kino owes its power of communicating a green colour to the salts of iron.

PHYSIOLOGICAL EFFECTS.—Astringent. Less effective, and less readily dissolved in the alimentary juices than catechu, to which, in its operation, it is closely allied.

USES.—Employed in medicine as an astringent only; principally in obstinate chronic *diarrhœa*. In this disease it is usually given in combination with chalk, and frequently with opium. In *pyrosis*, the compound powder of kino (*i. e.* opium and kino) has been found serviceable. Dr. Pemberton⁴ ascribes to kino a power of restraining the discharge of the mucous glands of the intestinal canal when they are secreting too much, and of contracting vessels already too much relaxed, without exerting any such power over the glands and vessels when they are acting naturally. It has been administered as an astringent in *leucorrhœa* and *sanguineous exhalations*, and as a tonic in *intermittents*. As a topical astringent it has been applied to flabby ulcers, and used as a gargle, injection, and wash.

ADMINISTRATION.—The dose of the powder is grs. x.

1. TINCTURA KINO, L. E. [U. S.]; *Tincture of Kino*.—(Kino, bruised, ℥iiss; Rectified Spirit Oij. Digest for seven days, and strain. "This tincture cannot be conveniently prepared by the process of percolation," E.)—[The U. S. Pharm. directs kino in powder ℥vj; Diluted Alcohol q. s. Mix the kino with an equal bulk of sand, and having introduced it into a percolator, pour Diluted Alcohol gradually upon it until eight fluidounces of filtered liquor are obtained.]—Astringent. Used in *diarrhœa* and hemorrhages, generally as an adjunct to the chalk mixture. Dose, fʒj to fʒij. It is said that by keeping this tincture has in some instances become gelatinous, and lost its astringency. Where this occurred, probably the *Botany Bay kino* (inspissated juice of the *Eucalyptus resinifera*) had been employed.

2. PULVIS KINO COMPOSITUS, L.; *Compound Powder of Kino*.—(Kino ℥xv; Cinnamon ℥ss; Dried Opium ʒj. Rub them separately to a very fine powder; then mix them.)—Twenty grains of this powder contain one grain of opium. This powder is employed as an astringent in chronic *diarrhœa* and *pyrosis*. The dose of it is grs. v to ʒj.

¹ Fl. Ind. iii. 235.

² Pharm. Central-Blatt. für 1833, S. 629 and 652.

³ Ann. de Chim. xlv. 321.

⁴ Diseases of the Abdom. Viscera.

Sub-order II. MIMOSÆ.

278. ACACIA, *De Candolle*.—VARIOUS SPECIES YIELDING GUM, *E.**Acaciæ species variæ, L. —Acacia verek et A. vera, D.**Sex. Syst. Polygamia, Monœcia.**(Gummi, L. D.—Gum, E.)*

HISTORY.—The Shittah tree,¹ whose wood is mentioned in several parts of the Old Testament,² is supposed to have been an *Acacia*. By some it has been thought to have been the *A. vera*,³ by others the *A. horrida*.⁴

Hippocrates speaks of the *Acacia*,⁵ which he sometimes calls the *Egyptian Acacia*,⁶ at other times the *White Acacia*.⁷ He is usually supposed to refer to *Acacia vera*; but Dierbach⁸ is of opinion that *A. Senegal* is meant; which, he observes, is distinguished by its white bark, white wood, and white flowers, and therefore the term *white* could apply to it only. Furthermore, the *white fragrant ointment*⁹ was probably prepared from the flowers of the *A. Senegal*, and not of *A. vera*, whose flowers would yield a yellow ointment, and have not such an agreeable odour as those of the former species. Hippocrates¹⁰ also mentions *gum* (ξύμμι), which he used in medicine. Delile¹¹ considers the "Ἀκανθα δίψας (*Thirsty Thorn*) of Theophrastus¹² to be *Acacia Seyal*, which Pliny¹³ calls *Spina sitiens*.

BOTANY. **Gen. Char.**—*Flowers* polygamous. *Calyx* 4- to 5-toothed. *Petals* 4 to 5, either free or cohering to form a 4- to 5-cleft corolla. *Stamens* varying in number, 10 to 200. *Legume* continuous, juiceless, 2-valved.—*Shrubs* or *trees*. *Thorns* stipular, scattered, or none. *Flowers* yellow, white, or rarely red, capitate or spiked. (*De Cand.*)

Species. 1. *A. VERA*, Willdenow, L. D.; *Mimosa nilotica*, Linn.; *Egyptian Thorn*.—*Spines* in pairs. *Branches* and *Leaves* smooth. *Pinnæ* 2 pairs; *leaflets* 8 to 10 pairs, oblong-linear; with a gland between the pinnæ. *Flowers* in globose heads; heads about two together, stalked, axillary. *Legume* moniliform. (*De Cand.*)—*Middling-sized tree*. *Flower-heads* bright yellow.—A native of Arabia, and of Africa from Senegal to Egypt. Its fruit, termed *Egyptian and Senegal bablah* (*bablah d'Egypte et du Sénégal*, Guibourt), has been employed in tanning and dyeing. The *succus acaciæ veræ* is the inspissated juice of the unripe fruit, and was formerly used as an astringent. *Acacia vera* yields *gum Arabic*, and also a portion of the *gum Senegal*.

2. *A. ARABICA*, Willd. D.; *Acacia nilotica*, Delile; *Mimosa arabica*, Roxburgh.—*Spines* in pairs. *Branches* and *petioles* pubescent. *Pinnæ* 4 to 6 pairs; *leaflets* 10 to 20 pairs, oblong-linear, with a gland beneath the inferior and often between the last pinnæ. *Flowers* in globose, stalked, axillary, subternate heads. *Legume* moniliform. (*De Cand.*)—A small *tree*. *Flower-heads* yellow.—Considered by Ehrenberg to be a variety of the preceding species.—A native of Senegal, Egypt, Arabia, and India.—Its fruit, termed *Indian bablah* (*bablah de l'Inde*, Guibourt), is used for tanning and dyeing. Probably yields part of the *gum Arabic* and *East Indian gum*.

3. *A. KAROO*, Hayne, Nees and Ebermaier.—Cape of Good Hope. Said to yield *Cape gum*.

4. *A. GUMMIFERA*, Willdenow.—Arabia; Africa,

Fig. 366.

*A. arabica.*¹ Isaiah, xli. 19.² Carpenter, *Script. Nat. Hist.*³ Ἀκανθα, or Thorn, p. 568, ed. Fœs.⁴ Ἀ. λευκή, p. 632.⁵ Μύρον λευκὸν αἰγυπτίων, p. 265.⁶ Flore d'Egypte, p. 266, fol.⁷ Hist. Nat. lib. xiii. cap. 1, ed. Valp.⁸ As Exod. xxv. 5.⁹ Picture Bible.¹⁰ Ἀ. αἰγυπτία, p. 671.¹¹ Arzuein, d. Hippok.¹² Pages 667 and 686.¹³ Hist. Plant. lib. iv. cap. 5.

near Mogadore. Said by Forskål¹ to yield a gum, which is collected by the Arabs. Probably furnishes, in part at least, *Barbary gum*.

5. A. SEYAL, Delile.—Egypt and Senegambia. Yields a gum which forms part of *gum Senegal*. The tears are white, hard, vitreous, and vermiform.

6. A. TORTILIS, Forskål, Nees, and Ebermaier.—Arabia. Its gum is collected by the Bedouins of the desert.

7. A. EHRENBERRGH, Hayne, Nees, and Ebermaier.—Arabia. Its gum is collected by the Bedouins of the desert.

8. A. SENEGAL, Willdenow; A. *Verek*, Adanson.—Arabia and Africa, from Senegal to the Cape of Good Hope. Abundant in the forest of Sahel, near Senegal. Yields *gum Senegal* in vermiform, ovoidal, or spheroidal tears, which are wrinkled externally, but are transparent internally.

PRODUCTION OF GUM.—The gum of the Acacia trees flows, in the liquid state, from the trunk and branches, and hardens by exposure to the air. It usually exudes spontaneously (see some remarks on the cause of the exudation of gum, *ante*, p. 820). In some instances, however, the discharge is facilitated by incisions. In Barbary, the largest quantity of gum is procured during the hot and parching months of July and August. "The more sickly the tree appears, the more gum it yields; and the hotter the weather, the more prolific it is. A wet winter and a cool or mild summer are unfavourable to the production of gum."² In Senegal, the gum begins to flow when the tree first opens its flowers;³ and it continues during the rainy season till the month of December, when it is collected for the first time. Another collection of the gum is made in the month of March, from incisions in the bark, which the extreme dryness of the air at that time is said to render necessary.⁴

COMMERCE.—Acacia gum is the produce of Africa principally, and of Asia. It is imported from the Levant and other parts of the Mediterranean, from Barbary, Senegal, the East Indies, and the Cape. It comes over in chests, casks, skins, serous, and bags. The duty on it is 6s. per cwt. The following are the quantities on which duty was paid in 1839:—⁵

	Cwt.
Gum from the East Indies	7,869
Senegal gum	24,698
Other sorts of gum	7,759
Total	40,326

DESCRIPTION.—Acacia gum (*gummi acaciæ*) occurs in variable-sized tears, which are inodorous, more or less coloured, have a slightly sweetish taste, and a greater or less degree of transparency. Ehrenberg asserts that the characters of gum of the same species of plant are liable to considerable variation. Thus the same tree may yield a transparent or an opaque, a light or a dark coloured, gum. The following are the most important varieties of Acacia gum:—

1. Turkey or Arabic Gum (*Gummi turcicum* seu *arabicum*; *Gummi Mimosæ verum*, Martius; *Gomme arabique vraie*, Guibourt).—This is imported from Leghorn, Malta, Trieste, Gibraltar, Smyrna, Alexandria, Beyrout, Constantinople, &c. It is the produce of *Acacia vera*, and probably of other species, especially *A. arabica*. It occurs in rounded tears, or amorphous or angular pieces, varying in size from a pea to that of a walnut, or even larger than this; some of the pieces being transparent, others more or less opaque, from innumerable cracks extending through them. It has a glassy lustre, is white, yellow, or wine-yellow, and has no odour, or, if any, an acid one. Its specific gravity varies from 1.316 to 1.482. It may be readily broken into small fragments. It is entirely soluble in water, the solu-

¹ Fl. Egypt. Arab. cxxiv.

² Jackson, *Account of the Empire of Morocco*, p. 137, 3d edit.

³ Adanson, *Mém. de l'Acad. des Sc. de Paris*, p. 8, 1773.

⁴ Demaneuf, *Nouv. Hist. de l'Afrique Française*, t. i. p. 56; quoted by Woodville, *Med. Bot.* vol. ii. p.

158.
⁵ Trade List.

tion having the property of reddening litmus, and being feebly opalescent. The latter property is said, by Guerin, to be owing to a small quantity of insoluble nitrogenous matter present. The white pieces constitute the *gummi electum* of our druggists. On the continent, they are called *gum Turic* (*gomme Turique*), from *Tor*, the name of a seaport of Arabia, near the isthmus of Suez; while the red pieces are sometimes said to constitute the *gum Gedda* (*gomme Jedda*, or *Gedda*), so called after another port. Gum Gedda is occasionally imported into this country unmixed with other kinds of gum. In all the entries of it which I have been able to trace, it came from Alexandria, in barrels.

2. Barbary or Morocco Gum (*Gummi Barbaricum*).—This is imported from Mogadore and Mazagan. In 1830, there were imported from Tripoli, Barbary, and Morocco, 2,063 cwt. of gum.¹ Barbary gum is probably the produce of *Acacia gummiifera*. Jackson says it is obtained from a high thorny tree, called *Attaleh*. The best kind is procured from the trees of Morocco, Ras-el-wed, in the province of Suse, and Bled-hummer, in the province of Abda; the second qualities are the produce of Shedma, Duguella, and other provinces. I have two varieties of Barbary gum; one (the *Gomme de Barbarie* of Guibourt) is in roundish or irregular tears, mixed with many impurities, imperfectly transparent, and of a dull yellowish colour, with a faint tint of green.—It is imperfectly soluble in water and has some analogy to Senegal gum. The other kind (called *Mogadore gum*) is in small, angular, broken, mostly yellow pieces, which resemble fragments of Turkey gum.

3. Gum Senegal (*Gummi Senegalense*).—This gum is imported from St. Louis, St. Mary's, the River Gambia, Senegal, and Bathurst. In 1839, duty (6s. per cwt.) was paid on 24,698 cwt. Gum Senegal is probably obtained from several species of *Acacia*; but especially *A. Senegal*, *A. vera*, *A. Seyal*, and *A. Adansonii*, are said to produce it in part. It occurs in larger tears than those of Turkey or Arabic gum. On breaking them, we frequently find large air-cavities in their centres. Occasionally, we meet with whitish pieces, but for the most part they are yellow, reddish-yellow, or brownish-red. More difficulty is experienced in breaking or pulverizing this gum than gum Arabic, and its fracture is more conchoidal. The taste of this gum is similar to that of the last.

Guibourt distinguishes two varieties of this gum, one of which he terms *Gomme du Bas du Fleuve*, or *gum Senegal*, properly so called; the other, the *Gomme du Haut du Fleuve*, or *Gomme de Galam*. The first is probably the produce of *Acacia Senegal*, while the second is procured from *A. vera*. There is but little difference between them; yet gum Galam has a greater resemblance to Turkey gum than Senegal gum has; the pieces are more broken, and therefore more brilliant, than those of gum Senegal, properly so called. Those pieces of gum which have on some part of them a yellowish opaque skin or pellicle, constitute the *Gomme pelliculée* of Guibourt. The *Marrons de Gomme*, or *Gomme lignirode*, of the same pharmacologist, is also found in the Senegal gum of commerce; it consists of yellowish or dark-brownish pieces, which are difficult to break, opaque, and rough. Treated with water it is partially dissolved, leaving, says Guibourt, a residue of gnawed wood (*bois rongé*). Guibourt states that, in most of the *marrons*, he has found a large ovoid cell, which had been the habitation of the larvæ of some insect; whence he concludes that this substance is the work of an insect.

4. East India Gum (*Gummi indicum ostindicum*).—This variety is imported principally from Bombay. In 1839, duty (6s. per cwt.) was paid on 7,869 cwt. It is probably the produce of various species. Many pieces agree in their physical and chemical characters with Turkey and Arabic gum, and are probably the produce of *Acacia arabica*, or some allied species (*yellow E. I. Gum*). Others, however, are larger, red or brown, and more difficult to pulverize than Turkey or Arabic gum (*Brown E. I. gum*). Are these the produce of *Feronia Elephantum*?

I have received from Bombay three varieties of gum; one marked *Muculla best*

¹ Parliamentary Return.

gum Arabic, very similar to gum Galam; a second, marked *Mocha and Barbary gum*, in large reddish-coloured, rough tears; and a third, denominated *Surat inferior gum Arabic*, in smaller dark-coloured tears.

5. Cape Gum (*Gummi Capense*).—This is imported from the Cape of Good Hope. In 1829, there was exported from the Cape 16,943 lbs. and two cases of gum.¹ In 1830, the quantity imported into the United Kingdom was only 1 cwt. $\frac{3}{4}$ qrs. 14 lbs.;² but since then the importation has greatly increased. Mr. Burchell³ says Cape gum is obtained from a species of *Acacia* (which he has figured in vol. i. pp. 189 and 325) closely resembling *A. vera*, and which he calls *A. capensis* (*A. Karoo*, Hayne?). It is most abundant on the banks of the Gariep, and between the Cape and the Gariep. Notwithstanding that he asserts the quality of Cape gum is in no way inferior to that of *A. vera*, it is considered by our dealers as a very inferior kind. It is pale yellow; and its appearance resembles Mogadore gum (see *ante*, p. 828), or small fragments of Turkey gum. It is collected by the Caffres. Gum has also been imported from Australia and South America. A sample of South Australian gum, which the author examined, had more the appearance of Cherry-tree gum (cerasin) than of Gum Acacia.

Besides the preceding gums, there are several others described by continental pharmacologists, but which are almost unknown in English commerce. Such are the following:—

a. GUM BASSORA; Gummi Toridonense.—This gum occurs in variable-sized pieces, which are whitish or yellowish, and opaque. When put into water it swells up, but dissolves only in part. The insoluble portion has been called *bassorin*. Its origin is unknown. Virey thinks that it is produced by a *Mesembryanthemum*; Desvaux and Damart, by a *Cactus*.

β. GUM KUTTEERA.—Considered by Guibourt as identical with the preceding; but the sample given me by Professor Royle is very distinct. It has considerable resemblance to the flaky tragacanth (*ante*, p. 820), for which it has been attempted to be substituted.⁴ It is, probably, the produce of *Sterculia urens*, a plant belonging to the family *Byttneriaceae*.⁵

γ. Under the name of **HOG GUM**, I have met with, in commerce, an unsalable gum, which greatly resembles a sample sent me by Professor Guibourt, as *gomme pseudo-adraganthe*, or *Gomme de Sassa*.⁶ It is in reddish yellow, somewhat transparent masses, many of which are twisted like a snail's shell or an ammonite. Some of these are eight or nine inches in diameter. It is yielded by the *Maronchea Coccinea*, a guttiferous plant.

ADULTERATION.—The inferior and cheaper kinds of gum (as the Barbary, East Indian, and Senegal gums) are not unfrequently substituted for the Turkey or Arabic gum, especially in the form of powder. Flour (or starch) is sometimes mixed with powdered gum; the adulteration is readily recognized by the blue colour produced on the addition of a solution of iodine to the cold mucilage of suspected gum.

COMPOSITION.—Several *ultimate* analyses of gum have been made. The most important are those of Berzelius,⁷ Prout,⁸ Guerin,⁹ and Mulder.¹⁰

	Gum Arabic.			Gum Senegal.		Soluble part of Gum Bassora.
	Berzelius.	Prout.	Mulder.	Guerin.	Mulder.	Guerin.
Carbon . . .	41.906	41.4	45.10	43.59	44.92	43.46
Hydrogen . .	6.788	6.5	6.10	6.23	6.09	6.26
Oxygen . . .	51.306	52.1	48.80	50.07	48.99	50.28
Nitrogen . .	a trace	0.0	0.0	0.11	0.00	0.0
Total	100.000	100.0	100.00	100.00	100.00	100.00

The formula $C^{13}H^{13}O^{12}$ agrees with the analyses of Berzelius and Prout. Mulder gives, as the formula for gum Arabic, $C^{12}H^{10}O^{10}$. Liebig gives $C^{12}H^{11}O^{11}$. According to the first formula the atomic weight will be = 186; according to the second = 162; and the third = 171.

The *proximate* analysis of gum has been made by Guerin:—¹¹

¹ McCulloch, *Dict. of Com.*

² *Travels in the Interior of South Africa*, 1822-24.

³ Roxburgh, *Fl. Indica*, iii. 146.

⁴ *Ann. de Chim.* xcv. 77.

⁵ *Journ. de Chim. Méd.* vii. 742.

⁶ *Op. supra cit.*

⁷ *Parliamentary Return.*

⁸ *Nicholson's Journal*, vii. 301.

⁹ See his *Hist. des Drog.* ii. 447, 3me édit.

¹⁰ *Phil. Trans.* for 1827.

¹¹ *Pharm. Central-Blatt für 1839*, S. 137.

	<i>Gum Arabic.</i>	<i>Gum Senegal.</i>	<i>Gum Bassora.</i>
Soluble gum (<i>Arabin</i>)	79.40	81.10	11.20
Insoluble gum (<i>Bassorin</i>)	0.00	0.00	61.31
Water	17.60	16.10	21.89
Ashes	3.00	2.80	5.60
Total	100.00	100.00	100.00

1. **SOLUBLE GUM OR ARABIN.**—Is a colourless, inodorous, insipid, uncrystallizable solid soluble in both hot and cold water, but insoluble in alcohol, ether, and oils. It combines with alkalies. Sulphuric acid converts it into a saccharine substance. 100 parts of arabin treated with 400 parts of nitric acid yielded Guerin 16.88 of mucic acid, with a little oxalic acid. From *cerasin* or *prunin*, it is distinguished by its solubility in cold water. The characters by which it is distinguished from *tragacanthin*, *carrageenin*, and *cydonin*, have been already pointed out. According to Guerin, arabin consists of carbon 43.81, hydrogen 6.20, oxygen 49.85, and nitrogen 0.14.

2. **INSOLUBLE GUM OR BASSORIN.**—Is distinguished by its insolubility in water, both hot and cold. It absorbs water, and swells up. It is insoluble in alcohol. 100 parts treated by 1000 of nitric acid furnished 22.61 of mucic acid, with a little oxalic acid. It consists, according to Guerin, of carbon 37.28, hydrogen 55.87, oxygen 6.85.

3. **SALTS.**—The ashes of gums Arabic and Senegal consist of carbonates of potash and lime, with minute portions of chloride of potassium, oxide of iron, aluminum, silica, and magnesia. The carbonate of lime is formed by the decomposition of the malate of lime contained in the gum, while the carbonate of potash results from the decomposition of acetate of potash.

CHEMICAL CHARACTERISTICS.—*Gum Arabic* is soluble both in hot and cold water, forming mucilage. Its fresh solution has an acid reaction, probably from some vegetable, and alcohol added in excess precipitates the gum from it. Diacetate of lead causes a white precipitate (*gummate of lead*) with the solution, but a solution of pure Acacia gum is not precipitated by neutral acetate of lead. A solution of silicate of potash (prepared by fusing three parts of carbonate of potash with one part of silver sand) causes a white flaky precipitate. Oxalate of ammonia gives a white precipitate (*oxalate of lime*). When a concentrated solution of neutral sesquichloride of iron is dropped into a strong solution of gum, and the mixture stirred, the whole becomes, in a few minutes, a brown semitransparent jelly. Nitrate of mercury produces a precipitate with a solution of gum.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—The effects of injecting solutions of gum into the veins of animals (horses and dogs) have been examined by Viborg, Scheele, and Hertwich.¹ From their experiments it appears that small quantities only can be thrown into the circulation with impunity. From half a drachm to one or two drachms of gum, dissolved in one or two ounces of water, disorder the respiration and circulation of horses; while five or six drachms of gum give rise to an affection of the nervous system, manifested by stupor and paralysis, or convulsions. Some of these effects (namely, those on the pulmonary and vascular system) may arise from the non-miscibility of mucilage with the blood, and its consequent mechanical influence in obstructing the capillary circulation of the lungs.

β. On Man.—Regnandot² injected three drachms of gum, dissolved in three ounces of water, into the veins of a man aged twenty years. In half an hour the patient was very chilly; his pulse was small and quick, and he had three liquid stools. The chilliness was succeeded by great heat, and after fifteen hours an eruption appeared on the skin.

The local action of a solution of gum is that of an emollient, and (by its sheathing properties) demulcent. It is not known to possess any action over remote parts, though some have supposed it to have the power of diminishing irritation in the urinary organs.

USES.—Gum is employed in medicine as an emollient and demulcent, but more frequently as a vehicle for the exhibition of other medicines. It is sometimes slowly dissolved in the mouth, to allay troublesome cough, and to diminish irritation of the fauces, by diluting the acid secretions, and sheathing the parts from the action of the atmosphere. In inflammatory affections of the intestinal tube, as

¹ Wibmer, *Wirk. d. Arzneim. u. Gift.* Bd. i. S. 3.

² *Ibid. op. supra cit.* S. 6.

well as of the respiratory and urinary organs, gum is used as an emollient and demulcent. As a sheathing substance, a solution of gum may be employed in acrid poisoning; but of course its efficacy is mechanical merely. Powdered gum is occasionally applied to check hemorrhage from leech-bites. As a vehicle for the exhibition of other medicines, it is employed in the form either of powder or mucilage. The former is used to give bulk to active and heavy powders; as calomel, emetic tartar, &c., and in the preparation of lozenges. The latter is employed to suspend insoluble powders (as oxide of zinc and musk) in water, or to diffuse oily and resinous substances through aqueous fluids,¹ and to give form and tenacity to pills. Furthermore, the adhesive qualities of mucilage render it exceedingly useful for various other pharmaceutical purposes, although it is now generally superseded by dextrine.

ADMINISTRATION.—The dose of powdered gum is from \mathfrak{zss} to \mathfrak{zj} , or *ad libitum*.

1. MUCILAGO, E.; *Mucilago Acaciæ*, D.; *Mucilage*.—(Acacia, powdered, \mathfrak{zix} ; Cold Water Oj. The gum to be dissolved without heat, but with occasional stirring, and the solution to be strained through linen or calico.)—The *Dublin College* employs \mathfrak{ziv} of coarsely powdered gum to $\mathfrak{f\mathfrak{z}vj}$. of Water. Dissolve the gum in the water with occasional stirring; then strain through flannel. By keeping, mucilage, or solution of gum, readily becomes sour by the development of acetic acid. The pharmaceutical uses of mucilage have been above referred to. To render different substances miscible with aqueous vehicles, different proportions of mucilage are required. “Oils will require about three-fourths of their weight, balsams and *spermaceti* equal parts, resins two parts, and musk five times its weight.”²

2. MISTURA ACACIÆ, L. E.; *Acacia Mixture*.—(The mixture of acacia of the *London College* is similar to the mucilage of the other two Colleges. The formula is as follows: Acacia, powdered, \mathfrak{zix} : Distilled Water, boiling, Oj. Rub the acacia with the water, gradually poured in until it is dissolved. Hot water is not necessary for this preparation; and in the author’s opinion it has a tendency to acidify the gum, and render the solution somewhat acrid. The *Edinburgh College* gives the following formula for the acacia mixture, which is a compound preparation, and not merely a solution of gum in water: Mucilage $\mathfrak{f\mathfrak{z}ij}$; Sweet Almonds \mathfrak{zix} ; Pure Sugar $\mathfrak{z v}$; Water Oij. Steep the almonds in hot water, and peel them; beat them to a smooth pulp in an earthenware or marble mortar, first with the sugar, and then with the mucilage; add the water gradually, stirring constantly; then strain through linen or calico.)—Demulcent and emollient. Applicable to the same purposes as *Mistura Amygdalæ*, already mentioned. Dose, $\mathfrak{f\mathfrak{z}j}$ to $\mathfrak{f\mathfrak{z}ij}$.

3. TROCHISCI ACACIÆ, E.; *Gum Lozenges*.—(Gum Arabic \mathfrak{ziv} ; Starch \mathfrak{zj} ; Pure Sugar lb. j. Mix and pulverize them, and make them into a proper mass with rose water for forming lozenges.)—An agreeable pectoral. Employed to allay the tickling in the throat which provokes coughing.

[4. SYRUPUS ACACIÆ, U. S.; *Syrup of Gum Arabic*.—(Take of Gum Arabic \mathfrak{zij} ; Sugar $\mathfrak{z xv}$; Water $\mathfrak{f\mathfrak{z} viij}$. Dissolve first the gum in the water without heat, then the sugar with a gentle heat, and strain.)—This is a convenient pharmaceutical preparation in the formation of pills, &c. It is also convenient for the expeditious preparation of cough mixtures.]

¹ See *Experiments on Mixing Oils, Resinous and Pinguious Substances, with Water, by Means of a Vegetable Mucilage*, in the *Medic. Observ. and Inq.* vol. i. p. 412, 4th edit. 1776.

² Montgomery, *Observ. on the Dubl. Pharm.*

279. ACACIA CATECHU, Willdenow, L. E. D.—THE CATECHU ACACIA.

Mimosa Catechu, Linn.

Ses. Syst. Polygamia, Monœcia.

(Ligni exterioris extractum, L.—Extract of the Wood, E.—Extractum ex ligno, D.)
[Catechu, U. S.]

HISTORY.—It is somewhat uncertain who first described Catechu. Garcias ab Orto¹ was of opinion that it was the *Λύχιον Ἰνδικόν* of Dioscorides;² but Dr. Royle,³ in a very elaborate and learned paper on this subject, has apparently proved that the preparation referred to by the latter author is the produce of *Berberis Lycium*, Royle.

BOTANY.—**Gen. Char.**—See *Acacia* (ante, p. 826).

Sp. Char.—Arboreous. Branches armed with stipulary thorns, or occasionally unarmed. Young shoots, petioles, and peduncles, more or less pubescent. Leaves bipinnate; pinnæ 10 to 30 pairs; leaflets 30 to 50 pairs; petiole sometimes armed on the under side with a row of prickles, with one large gland below the lowest pair of pinnæ, and between the extreme 1 to 6 pairs. Spikes axillary, 1 to 4 together, shorter than the leaves. Flowers numerous. Petals united. Stamens distinct, numerous. Legumes flat, thin, straight, linear, glabrous, 4- to 8-seeded (Wight and Arnott). Tree from 15 to 20 feet high. Bark brown and scabrous. Wood hard and heavy; the interior (*duramen*) brown, dark red, or blackish; the exterior (*alburnum*) white, one or two inches thick. Flowers whitish or pale yellow.

Hab.—Various parts of the East Indies; now common in Jamaica.

MANUFACTURE OF CATECHU.—The manufacture of Catechu from the *Acacia Catechu*, as practised in Canara and Behar, has been described by Mr. Kerr⁴ and Dr. F. Buchanan Hamilton,⁵ while Dr. Royle⁶ has explained the process followed in Northern India. According to the last-mentioned gentleman, “the Kutt manufacturers move to different parts of the country in different seasons, erect temporary huts in the jungles, and, selecting trees fit for their purpose, cut the inner wood into small chips. These they put into small earthen pots, which are arranged in a double row along a fireplace built of mud (*choola*); water is then poured in until the whole are covered; after a considerable portion has boiled away, the clear liquor is strained into one of the neighbouring pots, and a fresh supply of material is put into the first, and the operation repeated until the extract in the general receiver is of sufficient consistence to be poured into clay moulds, which, in the Kherree Pass and Doon, where I have seen the process, are generally of a quadrangular form. This Catechu is generally of a pale-red colour, and is considered there to be of the best quality. By the manufacturers it is conveyed to Saharunpore and Moradabad, whence it follows the course of commerce down the Ganges, and meets that from Nepal, so that both may be exported from Calcutta.”

DESCRIPTION.—The term *Catechu* (from *cate* a tree, and *chu* juice) is applied to various astringent extracts (sixteen of which I have in my collection) imported from India and the neighbouring countries. A few years ago the terms *Catechu*, *Terra Japonica*, and *Cutch*, were employed synonymously; they are now, however, for the most part, used in trade somewhat distinctively, though not uniformly in the same sense. In the *Edinburgh Pharmacopœia*, catechu is correctly stated to be the “extract of the wood of *Acacia Catechu*, of the kernels of *Areca Catechu*, and of the leaves of *Uncaria Gambir*,” probably, too, from other plants. The following may be taken as a classification of the varieties of catechu commonly met with:—

¹ *Clussi Ezot.* lib. i. cap. 10, p. 163.

² *Linn. Trans.* vol. xvii. p. 83.

³ *Journey from Madras through Mysore, Canara, and Malabar*, vol. iii. p. 177, 1807.

⁴ *Illustr.* p. 152.

⁵ *Lib. i.* cap. 132.

⁶ *Med. Obs. and Inq.* vol. v. p. 151.

1. *Gambir Catechu*; *Catechu from Uncaria Gambir*.—The method of preparing Gambir, and the properties of the different commercial varieties of this extract, have been already described (see p. 696). I may farther observe, however, that the origin of these varieties of catechu I consider to be satisfactorily made out. They are imported under the name of Gambir from Singapore (where the *Uncaria Gambir* is cultivated, and an extract prepared from it; they agree with the published descriptions of gambir; and lastly, I find them to be identical with the gambir brought by Mr. Bennet from Singapore, and deposited in the Museum of the Medico-Botanical Society. [In the *London Pharmacopœia*, the Gambir catechu is described as an extract of the leaf of *Uncaria Gambir*.—Ed.]

2. *Betel-nut Catechu*; *Catechu of the Areca Catechu*.—The mode of preparing Betel-nut Catechu, as described by Heyne, has been already stated. Two kinds of astringent extract are said by him to be prepared from these seeds: one called *Kassu*, which is black, and mixed with paddy-husks; the other termed *Coury*, which is yellowish-brown, has an earthy fracture, and is free from the admixture of foreign bodies. I have been able to identify Kassu among the extracts of commerce; but have not satisfactorily made out Coury.

Kassu; *Dark-brown Catechu in circular flat cakes*; *Colombo or Ceylon Catechu or Cutch* (*Cachou brun, orbiculaire et plat*, Guibourt). Imported from Ceylon. Cakes round, flat, covered on one side with paddy-husks (glumes of rice), from two to three inches in diameter, scarcely one inch thick, and weighing from two to three ounces. Internally, they are dark, blackish-brown and shiny, exactly resembling Pegu Catechu. Examined by the microscope it is found to contain numerous large crystals. Common. Quality excellent.—A decoction of this catechu becomes turbid on cooling, and frequently produces a blue colour with a solution of iodine, owing to the presence of the rice starch.

That this extract is Kassu, and is obtained from *Areca Catechu*, is proved by two facts:—

a. It agrees with the Kassu of Heyne in its dark colour, and being intermixed with paddy husks.

β. It is imported from Ceylon, in which island catechu is obtained from *Areca Catechu*. For this information I am indebted to a letter (in my possession) addressed by Mr. Lear, acting superintendent of the Botanic Garden in Ceylon, to my late friend Mr. F. Sauer, assistant-surgeon in Her Majesty's 61st regiment, then stationed at Colombo. The letter is dated November 17, 1838, and contains the following passage: "Of kino and Gambir I am quite unacquainted, and also of the trees which produce them. I should be glad [of] any information on the subject. An extract from *Areca Catechu* (specimens of which I will procure you) has been supposed to be the *Terra Japonica* of the shops; but it is generally supposed to be produced from *Acacia Catechu*, a plant not in Ceylon."

3. *Cutch*; *Catechu of the Acacia Catechu*.—It is probable that a considerable number of the astringent extracts brought from India as catechu are the produce of the *Acacia Catechu*. Hitherto, however, a small number only have been positively identified.

a. *PALE, DULL CATECHU IN SQUARE CAKES*; *Cachou terne et parallépipède*, Guibourt; *Cachou en manière d'écorce d'arbre*, A. Jussieu. This perhaps is the *Bengal Catechu* of Davy.

It occurs in square cakes, usually about two inches long, two inches broad, and one in thickness. Usually, these cakes are irregularly broken, so that it is difficult to trace their angular character. They are heavier than water. Externally their colour is dark brown or blackish; internally, we observe darker and lighter layers, disposed in a schistose manner, like the bark of a tree. The darker layers are brown and somewhat shiny, the lighter ones are dull-reddish white. Examined by the microscope it is found to consist principally of small crystals. A decoction of one part of this catechu and twelve parts of water lets fall, on cooling, a copious whitish precipitate of *catechine*. I find this kind of catechu to be identical with the specimens brought by Dr. Royle from India, and which he saw prepared from *Acacia Catechu*. Moreover, it probably is the kind, the manufacture of which Mr. Kerr described; for he says it is in square pieces, the finest being whitish. So that it is manufactured in Balar, as well as in the more northern parts of India.

β. *DARK SHINY PEGU MASSIVE CATECHU*; *Pegu Catechu*; *Cutch*; *Cachou en masse*, *Cachou lucide*, *Cachou du Butea frondosa*, Guibourt. It is imported from Pegu in large masses, weighing sometimes a cwt. each. These masses are made up of layers composed of prismatic pieces, each from six to ten inches long, and two or three inches broad and deep. Each piece is enveloped in the leaves of *Naurlea Brunonis*, a native of Tavoy, Wallich. *Cut.* (not of *Butea frondosa*, as formerly supposed). When fractured, these pieces present a dark blackish-brown shiny surface, free from all impurities; some of the pieces, however, having a more reddish tint than

the others. Their taste is bitter and astringent. Fée states, though I know not on what authority, that this variety contains 57 per cent of tannic acid. Pegu catechu is largely employed, I am informed, for dyeing. The greater part of that brought to this country is exported for continental use. According to Herbert de Jager¹ the catechu of Pegu is obtained from the *Acacia Catechu*; and, he adds, that it is celebrated throughout India.

γ. **DARK CATECHU IN BALLS.**—I have two varieties of dark-coloured catechu in balls:—

αα. *Enveloped in leaves.*—This agrees in its appearance with the Pegu Catechu above mentioned, and like the latter is enveloped in leaves, apparently of the *Nuclea Brunonis*. The balls are round and about the size of small oranges (*Pegu Cutch in balls*?).

ββ. *Covered with Paddy Husks*—Balls more or less flattened, not exceeding the size of a small orange, and covered with paddy husks (glumes of rice). In other respects identical with the preceding. It agrees with the kind referred to by Dr. B. Hamilton, as being procured from *Acacia Catechu*. When the extract, he says, has acquired the thickness of tar, it is allowed to harden for two days, so that it will not run. "Some husks of rice are then spread on the ground, and the inspissated juice is formed into balls about the size of oranges, which are placed on the husks or on leaves."

4. *Catechu of unknown origin.*—The origin of the larger proportion of the catechus which I have met with, I have not been able to ascertain.

α. **BROWN CATECHU IN CONICAL MASSES FROM SIAM.**—This variety has recently been imported from Siam in bags. It is in masses shaped like a betel-nut, or rather that of a mullar or truncated olive, each weighing about a pound and a half. The flattened base is marked with the impression of the leaf of *Nuclea Brunonis*. Internally, this catechu is shiny and liver-coloured, strongly resembling hepatic aloes. In its other qualities it agrees with Pegu Catechu.

β. **CATECHU IN FLAT CAKES**—Under the name of *Cutch* I have received a catechu in flat cakes like the Colombo Catechu, but unmixed with rice glumes. The cakes have a rusty appearance externally.

γ. **BLACK MUCILAGINOUS CATECHU; Cacho noir et mucilagineux**, Guibourt.—In parallelopipeds of eighteen lines on the side, and an inch high. Internally black and shiny, somewhat similar to extract of liquorice. Quality bad.

δ. **DARK-BROWN SILICEOUS CATECHU IN FLATTENED, CIRCULAR, OR QUADRANGULAR CAKES; Cacho brun siliceux**, Guibourt. Formerly called by druggists *Terra Japonica*. Perhaps the *Bombay Catechu* of Sir H. Davy. It is in round or flattened masses, varying in weight from two or three ounces to several pounds; externally it is of a dull dark-brown or rusty colour, internally being shiny and blackish-brown. It is very heavy, and contains a large quantity of fine sand. Guibourt says, 100 parts of this catechu yielded 26 parts of earthy matter. But some of the specimens contain a much smaller proportion of earthy matter. Quality bad.

ε. **DULL REDDISH CATECHU IN BALLS; Cacho en boules, terne et rougeâtre** Guibourt.—In the collection of the Medico Botanical Society of London, it is marked *American Catechu*. Balls flattened, weighing three or four ounces, covered on one side with glumes of rice. Its fracture is dull, reddish, wavy, and often marbled. Quality good.

ζ. **PALE OR WHITISH CATECHU IN IRREGULAR LUMPS; Cacho blanc**, Guibourt.—I received this from Bombay, under the name of *Katha suffaid* (i. e. *pale or white catechu*). It is in lumps, which vary in size from that of a walnut to that of a small apple. The general form is rounded or oval, and somewhat flattened, the surface being very uneven, and of a dark or blackish-brown colour. Internally this variety is dull, and of a very pale colour. Guibourt says, it is almost white; but it has a pale-yellowish or brownish-red tint. Its taste is bitter, astringent and sweetish, with a smoky flavour. Hence, perhaps, the dark colour externally is derived from the masses being dried, or exposed to the smoke of a fire.

COMPOSITION.—Two kinds of Catechu were analyzed by Sir H. Davy.² In 1833, Buchner discovered in catechu a peculiar substance which has been denominated *Catechine*.³

DAVY'S ANALYSES.

	Bombay.	Bengal.
Tannic acid	54.5	48.5
Peculiar extractive	34.0	36.5
Mucilage	6.5	8.0
Insoluble matter (chiefly sand and lime)	5.0	7.0
Catechu	100.0	100.0

1. **CATECHINE.**—This has been already noticed (see *Uncaria Gambir*).

2. **TANNIC ACID.**—The general properties of this acid have also been before described. It is this substance which renders catechu so valuable to the tanner. The peculiarities of the tannic acid of catechu have been studied by Berzelius,⁴ but in consequence of the subsequent discovery

¹ *Miscellanea curiosa*, Dec. ii. Ann. iii. p. 9.

² *Pharm. Central-Blatt für 1833*, 629.

³ *Phil. Trans.* for 1803, p. 233.

⁴ *Traité de Chim.* t. v. 5-8.

of catechuic acid they require re-examination. The tannic acid of catechu is easily soluble in water and alcohol, but very slightly so in ether. The aqueous solution becomes coloured by exposure to the air. Its combinations with acids are very soluble. Alkalies do not precipitate it.

CHEMICAL CHARACTERISTICS.—The brown, filtered decoction of catechu reddens litmus, yields a blackish-green colour and precipitate (*catechuate* and *tannate of iron*) with the ferruginous salts, and a brownish-white one with acetate of lead. A solution of gelatine renders the cooled decoction turbid (*tannate of gelatine*). Alkalies deepen the colour of the decoction, but cause no precipitate. Sulphuric acid renders the decoction slightly turbid. The filtered decoction of several kinds of catechu (especially *pale catechu in broken square cakes*) deposits, on cooling, catechine. The decoction of *dark-brown catechu, in circular flat cakes*, when cold becomes blue (*iodide of starch*) on the addition of a solution of iodine.

PURITY.—The Edinburgh College states that “the finest qualities [of catechu] yield to sulphuric ether 53, and the lowest qualities 28 per cent. of tannic acid dried at 280°.” This proceeding, however, is not to be relied on as a test of the astringency of catechu, which can only be determined in the usual way by gelatine. This College errs in supposing that the ethereal extract is necessarily either wholly or in great part tannic acid; for catechuic acid, which constitutes a large portion of some kinds of catechu, is soluble in ether.

PHYSIOLOGICAL EFFECTS.—Catechu produces the local and general effects of the astringents already described. When of good quality, it is more powerful than kino. In its operation, it is closely allied to rhatany root (*Krameria triandra*).

USES.—Employed as an astringent in the following cases:—

1. *In affections of the mouth and throat.*—In various affections of the mouth and throat I have frequently employed catechu, and found it a convenient and efficacious astringent. Thus, in relaxed uvula, and in that slight chronic inflammatory affection of the throat usually denominated the relaxed sore throat, and which is especially observed in delicate females, catechu, chewed or sucked, is a most useful remedy. The pure kinds of catechu should be selected, especially avoiding those that are gritty. Catechu in the form of lozenges may be also employed. The pale kinds of catechu (as *gambir*, before described) are usually sweeter and more agreeable than the dark varieties. To public speakers or singers it is supposed to be useful; it prevents or diminishes hoarseness consequent on a too frequent use of the vocal organs. In slight ulcerations of the mouth also it is useful.

2. *As a stomachic in dyspeptic complaints.*—I have known catechu chewed with advantage in dyspeptic complaints. It should be used just before taking food; it promotes the appetite, and assists digestion.

3. *As an astringent* it may be employed in old-standing diarrhœas and dysenteries, when there are no inflammatory symptoms present. It is often conjoined with the chalk mixture, and not unusually with opiates.

4. *As an astringent in hemorrhages* of an atonic character. A scruple of catechu, with grs. xij of confection of opium, and a sufficient quantity of aromatic confection to make a bolus, was a favourite prescription of Dr. Babington, sen. in immoderate flow of the menses.¹

5. *In lead colic* it was recommended by Grashius.²

6. *In mucous discharges*, as gleet, fluor albus, or chronic old-standing cystirrhœa.

7. *As a topical application to ulcers.*—“An ointment composed of ℥iv of catechu, ℥ix of alum, ℥iv of white resin, and f℥x of olive oil, with a sufficient quantity of water, is in great repute in India as an application to ulcers.”³

ADMINISTRATION.—Dose, grs. x to 3j. It may be administered in the form of bolus, or of mixture with sugar and gum Arabic. For gradual solution in the mouth, I have found a lump of the purer kinds of commercial catechu more agreeable than *catechu lozenges*.

¹ Ainslie, *Mat. Ind.* i. 590.

² Thomson, *London Dispens.*

³ *De Colica Pictorum*, Amsterd. 1752.

1. **INFUSUM CATECHU COMPOSITUM**, L. D.; *Infusum Catechu*, E.; *Infusion of Catechu*.—(Catechu, powdered, ʒvj [in coarse powder, ʒiij, D.]; Cinnamon, bruised, ʒj [ʒss, D.]; [Syrup fʒiij, E.]; Boiling [distilled, L.] Water Oj [fʒxviij, E.; ʒix, D.]. Macerate the Catechu and Cinnamon in the Water, in a lightly covered vessel, for an hour [half an hour, D. Two hours, E.], then strain [through linen or calico, and add the syrup, E.].—Astringent. Adapted to diarrhœa. Dose, fʒj or fʒiij three or four times a day. Frequently given in conjunction with opiates. Sometimes used in the form of enema.

2. **TINCTURA CATECHU COMPOSITA**, L.; *Tinctura Catechu*, E. D. [U. S.]; *Tincture of Catechu*.—(Powdered Catechu [in coarse powder, E. D.] ʒiiss [ʒiv, D.] [ʒiij, U. S.]; Cinnamon, bruised [in fine powder, E.], ʒiiss [ʒij, D. U. S.]; Proof Spirit Oij. Macerate for [seven, L. E., fourteen, D.] days, and strain [and strongly express the residuum; filter the liquors, E.]. “This tincture may be also prepared by the process of percolation, the mixed powders being put into the percolator without being previously moistened with the spirit,” E.)—Astringent. Usually employed as an adjunct to chalk mixture in chronic diarrhœas and dysentery; or occasionally to Port wine, with some aromatic (nutmeg or cinnamon).—Dose, fʒj to fʒij.

3. **ELECTUARIUM CATECHU**, E.; *Confectio Catechu Compositum*, D.—(Catechu ʒiv; Kino ʒiv; Cinnamon ʒj; Nutmeg ʒj, E.; Opium, diffused in a little Sherry, ʒiiss; Syrup of Red Roses, boiled to the consistence of honey, Oiss. Pulverize the solids; mix the Opium and Syrup, then the powders, and beat them thoroughly into a uniform mass.)—Astringent. Employed in chronic diarrhœa, dysentery, and hemorrhages. Dose, ʒj to ʒij. The *Dublin College* orders the Electuary, now called Confection, to be made by adding five fluidounces of simple syrup to five ounces of compound powder of Catechu. The syrup is gradually added to the powder, and the ingredients are well mixed.

4. **PULVIS CATECHU COMPOSITUS**, D.—(Take of Catechu, Kino, of each ʒij; Cinnamon, Nutmeg, of each ʒss. Reduce each to powder, mix and pass through a fine sieve. When prepared, the powder should be kept in well-stopped bottles.)—The chief use of this compound is for the preparation of the confection above described.

280. ANDIRA INERMIS, Kunth.—THE CABBAGE-BARK TREE.

Geoffroya inermis, Swartz.

Sez. Syst. Diadelphia, Decandria.

HISTORY.—The medicinal properties of the bark of this tree were first pointed out by Mr. Duguid.¹ The first botanical description of the tree was published by Dr. Wright.²

BOTANY. **Gen. Char.**—*Calyx* turbinate-campanulate, 5-toothed; teeth almost equal, acute, erect. *Corolla* papilionaceous; the vexillum roundish, emarginate, larger than the keel. *Stamens* diadelphous (9 and 1). *Ovary* containing 3 ovules. *Legume* stalked, somewhat orbicular, rather hard, 1-celled, 1-seeded; when ripe, divisible into two valves, according to Swartz. (De Cand.)

Sp. Char.—*Leaflets* 13 to 15, ovate-lanceolate, acute, smooth on both sides. *Flowers* paniculate, with very short pedicels. *Calyx* urceolate, ferruginous-pubescent. (De Cand.)

Tree of considerable height. *Leaves* pinnate. *Flowers* reddish-lilac.

Hab.—West Indies.

DESCRIPTION.—*Cabbage bark* or *Worm bark* (*cortex andiræ inermis*, seu *geoffroyæ jamaicensis*) occurs in long, thick, fibrous pieces, having a brownish-ash colour, a resinous fracture, a disagreeable smell, and a sweetish, mucilaginous, bitter taste.

¹ *Edinb. Phys. and Lit. Essays*, vol. ii.

² *Phil. Trans.* vol. lxvii. part 2, p. 507.

SURINAM BARK (*cortex geoffroyæ Surinamensis*) is the bark of *Andira retusa*, var. *β. Surinamensis*. De Candolle. Huttenschmidt¹ found in it a white crystalline substance, which he called *Surinamin*. Surinam bark has been used as a vermifuge, but I am totally unacquainted with it.²

COMPOSITION.—Cabbage-bark was analyzed in 1824 by Huttenschmidt,³ who found in it the following substances: *Jamaicina*, yellow colouring matter, gum, much starch, wax, brown resin, a small quantity of mouldy matter, a nitrogenous substance soluble in carbonate of soda, oxalate of lime, and woody fibre.—The ashes contained carbonate, phosphate, and sulphate of potash, chloride of potassium, carbonate and phosphate of lime, with magnesia, silica, and oxide of iron.

JAMAICINA is a brownish yellow, crystalline, fusible, very bitter substance, composed of carbon, hydrogen, nitrogen, and oxygen. It is soluble in water and alcohol, and possesses alkaline properties. Its watery solution forms, with tincture of nutgalls, a yellow precipitate. Two grains of the acetate of jamaicina given to pigeons and sparrows, caused restlessness and trembling, and in half an hour violent purging.

PHYSIOLOGICAL EFFECTS.—Cathartic, emetic, and narcotic. In doses of thirty or forty grains, the powder of this bark purges briskly, like jalap. In larger quantities it causes vomiting, fever, and delirium. Fatal accidents are said to have resulted from its imprudent use.

USES.—Formerly employed as an anthelmintic, especially against the large round worm (*Ascaris lumbricoides*), but its use is now obsolete.⁴

[A formula for a decoction of this bark was given in the old *Dublin Pharmacopœia*, under the name of *Decoctum Geoffroyæ*. It is now, however, erased both from the *Materia Medica* and the pharmaceutical preparations. According to the plan which we have hitherto pursued, we have allowed the author's description of the Cabbage-bark tree to remain.—ED.]

ADMINISTRATION.—Dose of the powder, \mathfrak{zj} to \mathfrak{zss} . As an anthelmintic, the bark has been given in the form of decoction.

281. HÆMATOXYLON CAMPECHIANUM, L. E. D.—THE COMMON LOGWOOD.

Sex. Syst. Decandria, Monogynia.

(Lignum, L. D.—Wood, E.) [*Hæmatoxylon*, U. S.]

HISTORY.—Monardes⁵ calls the wood of this plant *lignum ad renum affectiones et urinæ incommoda*. Hernandez⁶ terms the wood *lignum nephriticum*; and describes the plant under the name of *coatlî*.

BOTANY. **Gen. Char.**—*Sepals* 5, united at the base into a somewhat persistent tube; the lobes deciduous, oblong-obtuse. *Petals* 5, scarcely longer than the sepals. *Stamens* 10; *filaments* hairy at the base; *anthers* without glands. *Style* capillary. *Legume* compressed, flat, lanceolate, acuminate at both ends, 1-celled, 2-seeded; the sutures indehiscent; the valves bursting in the middle longitudinally. *Seeds* transversely oblong; *cotyledons* 2-lobed.—*Tree*, with branches unarmed or spinous below the leaves. *Flowers* racemose, hermaphrodite. (De Cand.)

Sp. Char.—The only species.

Tree 40 or 50 feet high. *Leaves* pinnate or somewhat bipinnate by the conversion of the lowest pair of leaflets into two pairs of pinnæ; *leaflets* obovate or obcordate. *Flowers* yellow.

Hab.—Campeachy. Introduced into Jamaica, where it now grows in great abundance, wild.

COMMERCE.—The stems of the Logwood-trees are cut into logs or junks of about three feet long, the bark and white sap (alburnum) of which are chipped off, and

¹ *Op. infra. cit.*

² *Gmelin, Handb. d. Chem.* ii. 1264.

³ For further particulars respecting the uses of Cabbage-bark, consult Dr. Wright's paper, above referred to.

⁴ *Cusii Exot. cap.* xxvii. p. 324.

⁵ Göebel, *Pharm. Waarenk.* i. 201; Murray, *App. Med.* ii. 492.

⁶ *Rev. Med. Novæ Hisp. Thes.* 119.

the red part or heart (duramen) sent to England.¹ It is imported from Campeachy, Honduras, and Jamaica. In 1839, duty (3s. if from British possessions, 4s. 6d. if from other places) was paid on 15,867 tons.²

DESCRIPTION.—Logwood (*lignum hæmatoxyli seu campechianum*), as imported, consists only of the heartwood or duramen. The logs are externally of a dark colour; internally they are red. The wood is dense, has a sp. gr. of 1.057; admits of a fine polish, has a sweetish taste and a pleasant odour. Large crystals of hæmatin are sometimes found in the wood.³

COMPOSITION.—Logwood was analyzed in 1811 by Chevreul,⁴ who found its constituents to be *volatile oil, hæmatin, fatty or resinous matter, brown substance containing tannin, glutinous matter, acetic acid, woody fibre, various salts* (phosphate, sulphate, and acetate of lime, acetate of potash, and chloride of potassium) and the *oxides of aluminum, silicon, manganese, and iron.*

HÆMATIN or *Hæmatoxylin* is a red crystalline substance, of a slightly bitter, acid, and astringent taste. It is soluble in alcohol and ether, and slightly so in water. Acids render the solution yellowish or red; alkalis give it a purple or violet colour. Alum causes a violet precipitate, and several metallic solutions (as of tin and lead) a blue one. Gelatine produces a flocculent reddish precipitate.

CHEMICAL CHARACTERISTICS.—The decoction of logwood is deep red. Acids render it paler and brighter coloured. The alkalis give it a purplish or violet-blue colour. Acetate of lead causes a blue, alum a violet, precipitate. The salts of iron make it dark violet-blue. Gelatine forms a reddish precipitate with it.

PHYSIOLOGICAL EFFECTS.—Logwood is a mild astringent (see the effects of Astringents). It does not constipate nor so readily disorder the digestive organs as some other astringents, and hence its use may be continued for a longer period. Its colouring matter becomes absorbed, and may be detected in the urine. Dr. Percival⁵ states, that under the use of extract of logwood the urine of a female suddenly acquired a purplish-red colour, which was deepened by the sulphate of iron. After some hours, the secretion returned to its natural colour. The stools sometimes acquire a purplish-red colour from the use of logwood.

[Dr. J. M. Barry, of Totnes, Devon, has communicated to the author the particulars of a case, which shows that the use of logwood in chronic diarrhœa may be attended with the unpleasant effect of inducing phlebitis. In this case, the diarrhœa was of several years' standing; it had resisted all the usual remedies, but yielded to the exhibition of a few doses of a decoction of logwood. The arrest of the diarrhœa was almost immediately followed by *phlebitis*, affecting in a very marked manner the veins of one of the lower extremities. It was removed by active antiphlogistic treatment. The diarrhœa recurred, and the logwood was again prescribed, and the same effects ensued; the diarrhœa was checked, and the venous inflammation reappeared. In Dr. Copland's *Dictionary*, under the head of "Neuralgic Affections," p. 885, another case is mentioned in the following terms: "A gentleman from the country very recently came under my care for chronic diarrhœa of seven years' continuance. He had experienced two attacks of phlebitis of the femoral veins, consequent upon having taken the extract of logwood, this medicine having restrained but not arrested the diarrhœa." These facts will show that some caution must be used in the medicinal employment of logwood.—ED.]

USES.—In medicine, logwood is employed as an astringent in old diarrhœas and dysenteries, in hemorrhages (from the uterus, lungs, and bowels), and leucorrhœa. It is well adapted to the diarrhœas of children. Dr. Percival employed it to restrain profuse sweating in phthisis.

1. DECOCTUM HÆMATOXYLI, L. E. D. [U. S.]; *Decoction of Logwood.*—(Logwood, in chips, ʒx [ʒj, D. E. U. S.]; Water Oiss [Oj, E.; Oss, D.]; [Oij, U. S.]; Cinnamon, in powder, ʒj, E. Boil down to a pint and strain, L. Boil the logwood

¹ Wright, *Med. Plants of Jamaica*.

² Thomson, *Org. Chem.* 407.

³ *Works*, vol. iv. p. 386.

⁴ *Trade List*.

⁵ *Ann. de Chim.* lxxx. 128.

in the water down to ten fluidounces, adding the cinnamon towards the end, and strain, *E.* Boil for ten minutes in a covered vessel, and strain. The product should measure about eight ounces, *D.*)—[The *U. S. Pharm.* leaves out the cinnamon and boils to a pint, or half of the fluid away.]—Employed as an astringent in diarrhœa.—Dose, for adults, fʒj to fʒij; for children, fʒij to fʒss.

2. **EXTRACTUM HÆMATOXYLI**, *L. E.*; *Extract of Logwood*.—(Cut Logwood [in chips, *E.*] Hbiss [Hbj, *E.*]; Boiling [distilled, *L.*] Water Cong. ij [*a gallon*, *E.*].—Macerate for twenty-four hours, then boil down to a gallon [Oiv, *E.*], and strain the liquor while hot; lastly, evaporate, in the vapour-bath, to a proper consistence, *E.*)—The *London College* directs that the extract should be prepared in the same manner in which it has been ordered concerning extract of liquorice. “For preparing this extract, the logwood should not be powdered, but rasped, and it should be so far evaporated as to become brittle and pulverulent when cold. One cwt. of the wood yields about twenty lbs. of extract.”—Astringent. Employed in old diarrhœas, dysenteries, &c. Dose, grs. x to ʒss. By keeping, extract of logwood becomes exceedingly hard, and pills made of it are said to have passed through the bowels undissolved. It is employed, I am informed, to colour snuff.

282. TAMARINDUS INDICA, *Lin. L. E. D.*—THE COMMON TAMARIND TREE.

Sez. Syst. Monadelphia, Triandria.

(*Fructûs pulpa*, *L. D.*—Pulp of the pods, *E.*)

HISTORY.—The tamarind does not appear to have been known to the ancient Greeks; at least no mention is made of it in their writings. We are indebted for its introduction to the Arabians, who probably derived their knowledge of it from the Hindus. Mesue, Avicenna, and Serapion, are the earliest writers who mention it. It is said to have derived its name from *Tamar* (which, in Arabic, signifies *dates*), and *Indus*, in reference to its Indian origin.

BOTANY. **Gen. Char.**—*Calyx* tubular at the base; limb bilabiate, reflexed; upper lip 3-partite; lower broad, 2-toothed. *Petals* 3, alternating with the segments of the upper lip of the calyx; two of them ovate, the middle one cucullate. *Stamens* 9 or 10; seven very short and sterile, the others (two or three) longer, monadelphous, bearing anthers. *Style* subulate. *Legume* stalked, linear, more or less curved, slightly compressed, 1-celled, 3- to 12-seeded, the sarcocarp pulpy. *Seeds* compressed, bluntly 4-angled, obliquely truncated at the hilum. *Trees.* *Leaves* abruptly pinnated; *leaflets* many pairs. *Flowers* racemose (Wight and Arnott).

Sp. Char.—The only species. *Tree*, 30 to 40 feet high. *Branches* spreading. *Leaves* alternate; *leaflets* 12 to 15 pairs, small, oblong, obtuse, entire, smooth. *Petals* deciduous, yellow, veined with red.

There are two varieties, which are considered by Gaertner, Roxburgh, and De Candolle, as distinct species. The only difference between them is in the pod.

a. Orientalis; *T. indica*, De Candolle; *East Indian Tamarind*.—*Legume* elongated, six or more times longer than broad, 6- to 12-seeded.

β. Occidentalis; *T. occidentalis*, De Candolle; *West Indian Tamarind*.—*Legume* abbreviated, scarcely three times longer than broad, 1- to 4-seeded.

Hab.—East and West Indies.

PRESERVATION OF THE FRUIT.—The usual mode of preserving tamarinds in the West Indies, is to remove the shell or epicarp from the ripe fruit, and to place layers of the shelled fruit in a cask, and pour boiling water over them. But Dr. Wright² says a better method is to put alternate layers of tamarinds and powdered sugar in a stone jar. The drier and dark-coloured East Indian tamarinds are said to be preserved without sugar.

¹ Brande, *Man. of Pharm.*

² *Med. Plants of Jamaica.*

DESCRIPTION.—Tamarinds are imported both raw and preserved. *Tamarind pods* are from three to six inches long, more or less curved. Composed of a dry, brittle, brown, external shell (*epicarp*), within which is the acidulous, sweet, reddish-brown pulp (*sarcocarp*) penetrated by strong fibres. Still more internal is a thin membranous coat (*endocarp*) inclosing the oval brown seeds. *Preserved tamarinds* (*tamarindi conditi*) consist of the same parts, the shell (*epicarp*) excepted. The pulp (*pulpa tamarindi*) is the officinal part.

COMPOSITION.—Tamarind pulp was analyzed, in 1790, by Vauquelin,¹ who obtained the following products: *Citric acid* 9.40, *tartaric acid* 1.55, *malic acid* 0.45, *bitartrate of potash* 3.25, *sugar* 12.5, *gum* 4.7, *vegetable jelly* (pectin) 6.25, *parenchyma* 34.35, and *water* 27.55.

PHYSIOLOGICAL EFFECTS.—Tamarind pulp allays thirst, is nutritive and refrigerant, and, in full doses, laxative. From this combination of refrigerant and laxative properties it is commonly denominated a *cooling laxative*.

USES.—Tamarinds are adapted for febrile and inflammatory cases; in the former, it is often taken with the double purpose of operating as a refrigerant, and acting gently on the bowels. An infusion of tamarinds forms a very pleasant, cooling drink, as does also tamarind whey. Tamarinds are a constituent of several mild purgative preparations. They are frequently given in conjunction with senna (as in the *confection of senna*, Ph. D.) It is said, though I know not with what truth, that the addition of tamarinds to senna and resinous cathartics diminishes the operation of the latter.

ADMINISTRATION.—The dose of tamarinds is from ℥ij to ℥j or more. *Tamarind whey* (*serum lactis tamarindatum*) is prepared by boiling ℥ij of tamarind pulp with Oij of milk.

TAMARINDUS PRÆPARATUS, L.—(Tamarind ℔j; Water, as much as may be necessary to cover the tamarind. Macerate by gentle heat for four hours, and express the pulp first through a coarse, then through a fine sieve; lastly, evaporate to the consistence of a confection.)

283. CASSIA OFFICINALIS, Linn. L. (*Senna officinalis*, Roxb.)—SENNA.

Cassia lanceolata; C. *obovata*, De Cand.—*Cassia acutifolia*; C. *elongata*, D. E.

Sex. Syst. Decandria, Monogynia.

(*Folium, L.*—Leaves, D. E.)

HISTORY.—The early history of this purgative is somewhat obscure, but it was probably in use some centuries before any mention of it is made in the works of pharmacological writers. Among the Arabians I may quote Mesue, Serapion, and Avicenna, who notice senna (*sene*), but they refer to the fruit, and not to the leaves. Mesue, in speaking of the decoction of senna, quotes Galen, and from this, as well as from other circumstances, it has been imagined that Dioscorides and Galen, and probably even Theophrastus, were acquainted with senna; but their known writings do not warrant this opinion, and hence the quotation is presumed to be erroneous. The earliest Greek writer in whose works senna is mentioned, is Actuarius; but he, like the Arabians, referred to the fruit.

BOTANY. *Gen. Char.*—*Sepals* 5, scarcely united at the base, more or less unequal. *Petals* 5, unequal. *Stamens* 10, free, unequal; the three lower ones longer, the four middle ones short and straight, the three upper ones with abortive anthers. *Anthers* dehiscing at the apex. *Ovary* stalked, frequently arched. *Legume* vari-ous.—*Trees, shrubs, or herbs.* *Leaves* simply and abruptly pinnate. *Petioles* frequently glanduliferous. *Leaflets* opposite.

Species.—Some confusion still exists as to the species yielding the senna leaves of commerce. Linnæus made but one species, which he termed *Cassia Senna*, and considered the acute and obtuse-leaved plants as mere varieties. The usually-

¹ *Ann. de Chim.* v. 92.

accurate Woodville¹ has published a plate representing the leaflets of the acute-leaved Cassia, and the fruit of the blunt-leaved species. The following perhaps are distinct species, but their specific characters are not in all cases accurately ascertained. The *London College* has adopted the specific name *officinalis* in conjunction with *obovata*, and distinguishes the Alexandrian from the Indian senna, by the acute ovate or mucronate obovate leaves of the former, and the lanceolate leaves of the latter.

1. *C. OBOVATA*, *Colladon*;² *C. Senna* var. β ., *Linn.*; *C. obtusa*, *Roeb.*;³ *Senna belledy* (*Wild Senna*), *Egyptians* and *Nubians*; *Séné de la Thébaïde*, *Cassia Senna*, *Nectoux*.⁴—*Leaflets* 6 to 7 pairs, obovate, obtuse; petiole glandless. *Legumes* plano-compressed, curved, tumid by the crests on the middle of each valve (*De Cand.*)—*Perennial herb*, 1 or 2 feet high. *Leaves* smooth; *leaflets* mucronate, unequal at the base. *Stipules* lanceolate, linear, spreading. *Flowers* yellow in racemes. *Legumes* oblong, falcate, smooth, rounded at each end, with an equally interrupted ridge along the middle of each valve.—*Egypt* (*Bassà-Tine* at the entrance of the valley of *Egaremont*, two leagues from *Cairo*; *Karnak*; *Thebes*; on the eastern bank of the Nile opposite *Hermouthis*; *Esneh*; *Edfou*; *Daraou*; *Assouan*); *Nubia*; *Desert of Suez*; *Syria*; *India*. Cultivated in *Italy*, *Spain*, *Jamaica*, &c.—Its leaflets form *Aleppo*, *Senegal*, and *Italic Senna*, and one of the constituents of *Alexandrian Senna*.

Nees and *Ebermaier*⁵ follow *Hayne* in admitting two species of blunt senna, viz. *C. obovata*, *Hayne*, with obovate, very shortly pointed leaflets, and *C. obtusata*, *Hayne*, with more remote, obovate, truncated-emarginate leaflets. I think, with *Th. Martius*,⁶ that the latter are merely older leaflets than the former.

2. *C. ACUTIFOLIA*, *D.*, *Delile*.⁷—*Stem* suffruticose. *Leaves* pinnate; petiole glandless; leaflets 5 to 7 pairs, lanceolate, acute. *Legumes* flat, elliptical, naked on both sides, somewhat bent on the upper margin (*Delile*).—An undershrub, about two feet high. *Leaves* when young slightly silky or pubescent. *Flowers* yellow, in axillary racemes, at the top of the branches. *Petals* obovate. *Legumes* somewhat swollen by the seeds. *Seeds* 6 or 7 in each legume.—*Egypt*, in the valleys of the desert to the south and east of *Assouan*.—Collected by the *Arabs*, and sold by them to merchants who convey it to *Cairo*.

3. *C. ELONGATA*, *D.*, *Lemuire-Lisancourt*;⁸ *Fée*;⁹ *C. lanceolata*, *Royle*.¹⁰ Perhaps identical with the preceding species. *Dr. Royle's* specimens were raised from seeds picked out of *Mecca Senna*. *Dr. Lindley* thus describes the plant. "An annual, but, with care, it may be made to live through the year, and to assume a suffruticose habit. *Stem* erect, smooth. *Leaves* narrow, equal pinnated; leaflets 4 to 8 pairs, lanceolate, nearly sessile, slightly mucronulate, smooth above, rather downy beneath, with the veins turning inwards, and forming a flexuose intramarginal line; petioles without glands; stipules softly spinescent, semihastate, spreading, minute. *Racemes* axillary and terminal, erect, stalked, rather longer than the leaves; pedicels without bracts. *Sepals* linear, obtuse. *Petals* bright yellow. Of the stamens the five lowest sterile and small, the two next large, curved, and perfect, the three uppermost minute and gland-like. *Ovary* linear, downy, falcate, with a smooth recurved style. *Legumes* pendulous oblong, membranous, about an inch and a half long, and five-eighths broad, quite straight, tapering abruptly to the base, and rounded at the apex, deep-brown, many-seeded."—Grows in *India*, but probably only naturalized.—Yields *Tinnevely* and *Mecca Senna*.

4. *C. ÆTHIOPICA*, *Guibourt*;¹¹ *C. ovata*, *Mérat*;¹² *Séné de Nubie*, *C. lanceolata*, *Nectoux*;¹³ *C. Senna*, *Stevenson* and *Churchill*.¹⁴—*Leaves* of 3 to 5 pair of leaflets; petioles with a gland at their base, and another between each pair of leaflets; leaflets

¹ *Med. Bot.* iii. 446.

² *Fl. Ind.* ii. 344.

³ *Handb. d. med. pharm. Bot.* ii. 207.

⁴ *Fl. Egypt.* Pl. 27. fig. 1.

⁵ *Journ. de Chem. M d.* vi. 234.

⁶ *Hist. des Drog.* 3d edit. ii. 319.

⁷ *Voy. dans la Haute Egypte*, t. ii.

⁸ *Hist. des Casses*, 92.

⁹ *Pl. i.*

¹⁰ *Pharmakogn.*

¹¹ *Journ. de Pharm.* vii. 345.

¹² *Illustr.* t. 37.

¹³ *Dict. de Mat. Méd.* vi. 311.

¹⁴ *Med. Bot.* i. fig. 30.

oval lanceolate, pubescent. *Legumes* flat, smooth, not reniform, rounded, naked on both sides, containing from 3 to 5 seeds.—About 18 inches high. *Leaflets* from 7 to 9 lines long, and from 3 to 4 broad, consequently less elongated and less acute than those of the two preceding species. *Legumes* from 11 to 15 lines long, of a pale or fawn colour.—Nubia, Fezzan, to the south of Tripoli, and probably to Ethiopia. Yields *Tripoli Senna*. I think I have detected the leaflets in *Alexandrian Senna*.

5. *C. LANCEOLATA*, Forskål,¹ Lindley.²—Dr. Lindley, who met with this species in a collection of Arabian plants made by Dr. S. Fischer, says, “the leaflets are in four or five pairs, never more; oblong, and either acute or obtuse, not at all ovate or lanceolate, and perfectly free from downiness even when young; the petioles have constantly a small round brown gland, a little above the base. The pods are erect, oblong, tapering to the base, obtuse, rigid, mucronate, rather falcate, especially when young, at which time they are sparingly covered with coarse scattered hairs.” This species is therefore distinct from both *C. acutifolia*, Delile, and *C. elongata*, Lemaire. Forskål says it grows about Surdud, Mor, and Abuarish; and that it is the true *Merca Senna*.

6. *C. MARILANDICA*, Linn.—*Leaflets* 8 to 9 pairs, ovate oblong, mucronate, equal, with an ovate gland at the base of the petiole. *Racemes* axillary, many-flowered, shorter than the leaves. *Legumes* compressed, linear, hispid, subsequently smoothish (De Cand.)—From three to six feet high. *Flowers* golden yellow.—United States; common in all parts south of New York.—Yields the *American Senna*.

COMMERCE.—Senna is imported from the Mediterranean (either directly from Egypt, or at second hand from Italy), and from the East Indies (Madras and Bombay), usually in bales. The duty is 6*d.* per lb. The quantities on which duty was paid during two years were as follows:—

	In 1838.	In 1839.
From the East Indies	72,576 lbs.	110,409 lbs.
From other places	69,538 “	63,766 “
Total imported	142,114 “	174,175 “

DESCRIPTION.—Senna (*folia sennæ*) has a peculiar, agreeable, tea-like odour, and a nauseous bitter taste. Its colour should be bright and fresh. If largely mixed with extraneous matter, if it be much broken or very dusty, it should be rejected. Boiling water extracts about a third of its weight. Proof spirit yields a brown—alcohol or ether a green tincture.

1. *Alexandrian Senna*; *Senna Alexandrina*; *Folia Sennæ Alexandrinæ*.—Called by the French *Séné de la Pulthe* (i. e. *Tribute Senna*), because it is obliged to be sold to the Egyptian government, who resell it to Europeans. It is imported in bales from Alexandria and other Mediterranean ports. It consists of the leaflets of two or more species of *Cassia* (*C. acutifolia*, *C. obovata*, and, I think, sometimes *C. æthiopica*), mixed always with the leaves of *Cynanchum Argel*, and sometimes with those of *Tephrosia Apollinea*. The flowers and fruits of these plants are usually present in greater or less quantity. Alexandrian senna is collected in Nubia and Upper Egypt, and is conveyed down the Nile to the great dépôt at Boulak.

For the following particulars I am indebted to the writings of Delile,³ Rouillure,⁴ Nectoux,⁵ and Burekhardt.⁶ Senna is collected by the Arabs of the tribe of Abaddeh. They make two crops annually—the most productive one is that after the rains in August and September; the second takes place about the middle of March. When cut, the plants are spread out on the rocks, and dried in the sun (Nectoux).

Assouan is the first entrepôt for senna. It receives all that is gathered in the neighbourhood. Esneh is another entrepôt. It receives the acute-leaved senna from Abyssinia, Nubia, and Senaar, from whence it arrives by the caravans which convey negroes to Egypt, and blunt-leaved senna, gathered in Upper Egypt (Rouillure). Daraou, between Assouan and Esneh, is also an entrepôt; but the great dépôt is at Boulak, the port of Cairo. Here the monopoly of senna was farmed out by Mahommed Ali to Rosetti, an Italian, for about £3,500 per annum (Burekhardt).

¹ *Fl. Egypt. Arab.* 85.

² *Mém. sur l'Égypte*, iii. 315, 1799; and *Fl. Egypt.*

³ *Phil. Mag.* xv. 55; and *Voyage dans la Haute Égypte*, 1808.

⁴ *Travels in Nubia*, 2d edit. pp. 22 and 49.

⁵ *Fl. Med.* 259.

⁶ *Ann. de Chim.* lvi. 161.

The senna arrives at Boulak from Assouan, not only by the Nile, but also by the way of Cosseir, the Red Sea, and Suez. As, however, the latter is a more expensive route, it is not so frequently followed (Nectoux). Lastly, some senna is carried to Boulak by the caravans from Mount Sinai. The following are said by Rouillure to be the quantities brought from these places:—

QUINTALS.

	<i>Acute-leaved Senna.</i>	<i>Obovate ditto.</i>	<i>Ethiopic ditto.</i>	<i>Argel leaves.</i>
From Assouan	7000 to 8000 . . .	500 to 600 . . .	. . . . .	2000 to 2400
From Esneh . . . . .	. . . . .	800 . . .	2000 . . .	. . .
From Suez and Mount Sinai . . .	. . . . .	1200 to 1500 . . .	. . . . .	. . .
Total of each kind . . .	7000 to 8000 . . .	2500 to 2900 . . .	2000 . . .	2000 to 2400

So that the total amount of all kinds is, according to this statement, 13 500 to 15,300 quintals.

The mixture of the different leaves takes place at the entrepôts. Nectoux mentions those of Kénéh, Esneh, Daraou, Assouan, where it is effected. Rouillure says that at Boulak, 500 parts of acute leaves are mixed with 300 of obtuse leaves, and 200 of Argel leaves.

From Boulak the senna is sent to Alexandria, and from thence is shipped to Europe.

Alexandrian senna has a grayish-green colour, an odour which somewhat resembles that of tea, and a viscid taste. It presents a broken appearance, and on examina-

Fig. 367.



Alexandrian Senna.

- a.* Leaf of *Cassia acutifolia*.
- g.* Pod of ditto.
- b.* Leaf of *C. obtusata*.
- c.* Leaf of *C. obovata*.
- h.* Pod of ditto.

- e.* Leaf of *Cynanchium olæfolium*.
- k.* Pod of ditto.
- d.* Leaf of *Tephrosia apollinea*.
- i.* Pod of ditto.
- f.* Leaf of *Coriaria myrtifolia*.

tion is found to consist of the leaves, flowers, and fruits of the above-mentioned plants mixed with various extraneous matters (as seeds, date-stones, rabbit-dung, stones, &c.) The latter are in great part separated by hand-picking, sifting, &c., before the senna is fitted for use. It then constitutes *picked Alexandrian senna* (*folia sennæ Alexandrinæ electæ*).

α. **CASSIA LEAFLETS, FLOWERS, and LEGUMES.**—The leaflets of cassia are readily distinguished from those of other genera found in senna, by being unequal-sided; that is, by two sides of the leaflet being unequal in size, shape, or length, and by the veins or nerves of their under surface being very conspicuous. The acute-leaved are very readily distinguished from the blunt-leaved species, by their shape. The dried flowers of Cassia may be easily detected; they are dull yellow. I have not been able to make out their species. The legumes of the obovate and acute-leaved Cassia are also found; they are distinguished by the botanical characters before described.

β. **ARGEL LEAVES, FLOWERS, and FRUIT** (*Cynanchum*).—The Argel plants are collected by the Arabs, in the valleys of the Desert to the east and south of Assouan (Delile). The leaves found in Alexandrian senna are distinguished from the senna leaflets by their being equal-sided—by the absence, or imperfect development of their lateral nerves—by their paler colour, thicker and more coriaceous texture—by a yellowish exudation frequently found on them—and generally, though not invariably, by their greater length. Under the name of *heavy senna* I have met with argel leaves which were sold at a higher price than ordinary senna. These leaves were left in the fanning process, by which the real senna leaves were separated. By careful picking, the flowers may be detected; they are white, and in small corymbs. In some recently-imported bales, argel flowers constituted nearly a fourth part. The fruit, as found in Alexandrian senna, seldom exceeds in size that of a good-sized orange-pip. It is an ovoid follicle, tapering superiorly, brown, shrivelled, and contains several seeds.

γ. **TEPHROSIA LEAFLETS and LEGUMES.**—The *Tephrosia Apollinea* (*Galega Apollinea*, Delile, pl. 53) grows in cultivated fields near the Nile, at Hermonthis, at Edfou, and in the Elephantine Islands opposite Assouan. The leaflets have a silky or silvery aspect; they are obovate-oblong, somewhat cuneiform, emarginate, equal-sided, tapering towards the base; lateral veins parallel, regular, and oblique to the midrib. These leaflets are usually found loaded longitudinally, and are very apt to be overlooked. The legume is from an inch to an inch and a half long, not exceeding two lines broad, linear, slightly ensiform, and contains six or seven brownish seeds.

2. **Tripoli Senna; *Senna Tripolitana*; *Folia Sennæ Tripolitanae*.**—It is carried to Tripoli in caravans, which go from Fezzan. In general appearance it resembles Alexandrian senna; but the leaflets are more broken, smaller, less acute than the acute-leaved Alexandrian senna, thinner, greener, and of a less herbaceous odour. They are the produce of *C. Æthiopica*, usually unmixed with any other species. But I have a sample which contains also the leaflets of *C. obovata* and argel leaves.

Tunis senna agrees with that of Tripoli.

3. **Aleppo Senna.**—Consists of the leaflets of *C. obovata*.

4. **Senegal Senna; *Senna Senegalensis*.**—Is a blunt-leaved senna, having a rougher and more glaucous appearance than the leaflets of *C. obovata*. Some years since, a small bale of it was sent by the French *Ministre de la Marine* to M. Henry for examination.¹ I am indebted to the kindness of Professor Guibourt for a sample of it.

5. **Smyrna Senna.**—Very similar to Tripoli senna, but some of the leaflets resemble the acute-leaved Alexandrian senna.

6. **Mecca Senna; *Senna Meccensis*; *Inferior* or *Second East Indian Senna*; *Séné Moku*, Guibourt; *Séné de la Pique*, or *Pike Senna*; *Suna Mukkee*, Royle.**—Imported into England from India. It is the produce of Arabia, and finds its way into the interior of India by the ports of Surat and Bombay. Dr. Royle was informed that it was grown somewhere in the Agra and Muttra district, but was never able to prove the fact.² It occurs in long narrow leaflets, of from an inch to an inch and a half long, narrower than those of Tinnevely senna, and of a yellowish colour; some of the leaflets being brownish, or even blackish. This change of colour is probably the result of the action of a moist atmosphere. Legumes are occasionally intermixed; they are from 1½ to 3 inches long, and from 7 to 8 lines broad; slightly curved, greenish in their circumference, blackish in their centre, with a smooth surface. Recently this senna in good condition has been imported from Turkey in casks. It appears to be fresh and fine, and approximates to Tinnevely senna in colour; but contains stalks and dust with a few stones.

7. **Tinnevely Senna; *Finest East Indian Senna*; *Séné de l'Inde*, Guibourt.**—Cultivated at Tinnevely, in the southern part of India, by Mr. G. Hughes. It is

¹ Journ. de Pharm. xiv. 70.

² Illustr. 187.

a very fine unmixed senna, which is extensively employed, and fetches a good price. It consists of large, thin, unbroken leaflets, of a fine green colour, from 1 to 2 inches, or more, long, and sometimes half an inch broad at their widest part. When exposed to a damp atmosphere, they are apt to change colour, and to become yellow or even blackish.

8. American Senna; *Senna Americana*.—Is the produce of *Cassia Marilandica*, but never reaches this country as an article of commerce. That which I have received was prepared by the Shakers of the United States, and has been compressed into an oblong cake. The leaflets are oblong, lanceolate, from $1\frac{1}{2}$ to 2 inches long, and from $\frac{1}{4}$ to $\frac{1}{2}$ an inch broad, thin, pliable, and of a pale green colour. They have a feeble odour and a nauseous taste, like the other sennas.

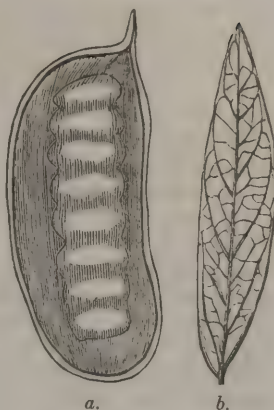
ADULTERATION.—Senna is not, to the best of my belief, adulterated in this country. The leaflets of *Colutea arborescens* or *Bladder Senna* have, on the continent, been occasionally intermixed. They are elliptical, regular, and obtuse. Their regularity at the base would at once distinguish them from the leaflets of *Cassia obovata*.

Argel leaves, mixed with a few leaflets of *C. acutifolia*, I have known to be recently sold as *picked* or *heavy senna* at a higher price. It was done rather from ignorance than fraud.

A serious adulteration has been sometimes practised on the continent, by the substitution of the leaves of *Coriaria myrtifolia* for those of senna.¹ They are ovate-lanceolate, grayish-green with a bluish tinge, 3-nerved, with a strongly-marked midrib; the two lateral nerves disappear towards the summit of the leaves. Chemically, these leaves are distinguished by their infusion yielding, with gelatine, a whitish precipitate (*tannate of gelatine*); and, with sulphate of iron, a very abundant blue precipitate (*tannate of iron*). Furthermore, it forms precipitates with bichloride of mercury, emetic tartar, and chloride of barium. [The true Senna leaf is unsymmetrical on the two sides, while in the leaf of *Coriaria* the two sides are equal and symmetrical.—Ed.]

COMPOSITION.—Three analyses of senna have been made; viz. one in 1797, by Bouillon La Grange;² a second by Braconnot;³ and a third, in 1821, by Lassaigne and Fenuelle:—⁴

Fig. 368.



a. Legume of Tinnevely Senna (*C. elongata*).
b. Leaflet of ditto (*Royle*).

Fig. 369.



Leaf of *Coriaria myrtifolia*.

SENNA LEAVES.

Braconnot.	
Bitter matter of senna . . .	53.7
Reddish-brown gum . . .	31.9
Matter similar to animal mucus, precipitable by acids	6.2
Acetate of lime	8.7
Malate (or some other vegetable salt) of lime	3.7
Acetate of potash	traces
Chloride of sodium	traces
Watery extract of Alex- andrian Senna	104.2

Lassaigne and Fenuelle.

Cathartin.
Yellow colouring matter.
Volatile oil.
Fixed oil.
Albumen.
Mucus.
Malic acid.
Malate and tartrate of lime.
Acetate of potash.
Mineral salts.
[Insoluble matter (lignin, &c.)]

Alexundrian Senna.

SENNA PODS.

Fenuelle.

Cathartin.
Yellow colouring matter.
Volatile oil.
Fixed oil.
Albumen.
Gum.
Malic acid.
Mulates of potash and lime.
Mineral salts.
Silicic acid.
Lignin.

Legumes of *Cassia acutifolia*.

1. ONOROUS PRINCIPLE; Volatile Oil of Senna.—Obtained by submitting the leaves, with water, to distillation. It has a nauseous odour and taste. The distilled water of senna, which contains some oil in solution, acts as a mild purgative only.

¹ Journ. de Chim. Mtd. i. 284.

² Journ. de Phys. lxxxiv. 281.

³ Ann. de Chim. xxiv. 3.

⁴ Ann. de Chim. et de Phys. xvi. 16.

2. **CATHARTINE**; *Purgative Principle of Senna*.—Yellowish-red, uncrystallizable, with a peculiar odour, and a bitter, nauseous taste; very soluble both in water and alcohol, but insoluble in ether; it attracts water from the air. Its aqueous solution is precipitated by infusion of galls and diacetate of lead. The sesquisulphate of iron and alkalies deepen the colour of the infusion: chlorine decolorizes it: iodine, acetate of lead, gelatine, and emetic tartar, cause no precipitates with it. It appears to consist of carbon, hydrogen, and oxygen only. Three grains caused nausea, griping, and purging.

CHEMICAL CHARACTERISTICS.—By boiling senna in water—by the exposure of infusion of senna to the air, as well as by the action of the mineral acids and of chlorine on the infusion—a precipitate is procured. Bouillon La Grange regarded this as a species of resin, formed by the union of oxygen with a peculiar kind of extractive found in senna. This extractive, he says, is inert, but becomes active when converted into resin; and hence, the cold infusion, according to this chemist, causes colic, but rarely purges. The carbonated alkalies, lime-water, nitrate of silver, the acetates of lead, sulphate of iron, &c., form precipitates with the infusion of senna.

PHYSIOLOGICAL EFFECTS. *a. On Animals*.—In doses of five or six ounces it purges horses. Courten¹ threw an infusion into the veins of a dog; it quickened the respiration, and caused vomiting. The animal appeared weak, was dull, and had no inclination to eat.

β. On Man.—Regnandot² injected half a spoonful of weak lukewarm infusion of senna into the left median vein of a young man affected with an herpetic eruption. The only effect produced was a slight temporary headache. Some days afterwards a spoonful was injected; in half an hour violent shivering and vomiting came on, which were followed by heat and purging. The febrile symptoms continued for several hours. Taken by the stomach, senna acts as a sure and safe purgative. Its ill effects are nausea, griping, flatulence, and, at first, depression, afterwards excitement of the pulse. It appears to stimulate the abdominal and pelvic vessels, thereby having a tendency to promote the hemorrhoidal and menstrual discharges. It is one of the mildest of the drastic purgatives. Unlike scammony, gamboge, jalap, and most other drastics, it does not rank among poisons, even when given in large doses. It is distinguished from the saline purgatives by its stronger and more irritant operation, by the heat, gripings, and increased frequency of pulse, which attend its purgative action. From rhubarb it differs in being more powerful and irritant in its operation, in being nearly or quite devoid of any tonic operation. It acts more speedily and powerfully than aloes, and in a less marked manner on the large intestines. In its operation it appears to rank between jalap and aloes. The petioles and stalks possess similar properties to the leaflets. Formerly the griping quality of senna was ascribed to the stalks, but both Bergius³ and Schwilgué⁴ have proved the error of this notion. The legumes are much milder in their operation than the leaflets.

Good East Indian senna is almost, if not quite, as active as the Alexandrian. Mr. Twining,⁵ after extensively trying it, declared it equal to the best he had ever seen. The obovate senna appears to be milder than the acute-leaved. The Senegal senna, before referred to, was found to possess less activity than ordinary senna. Part of the acrid and griping qualities of Alexandrian senna are referable to the arzel leaves, which, according to the observations of Rouillure, Delile, Nectoux, and Pugnet (quoted by Delile), possess greater activity than the true senna leaves. Rouillure says they purge and gripe, and are used by the Arabs of Upper Egypt without the addition of senna. These effects might be expected from the known properties of Asclepiadaceæ (before referred to). "American senna is an efficient and safe cathartic, closely resembling the imported senna in its action, and capable of being substituted for it in all cases in which the latter is employed."⁶

If infusion of senna be given to the nurse, the suckling infant becomes purged,

¹ Wibmer, *Wirk. Arzneim. u. Gifte*, ii. 67.

² *Mat. Méd.* i. 354

³ *Trans. Med. and Phys. Soc. of Calcutta*, v. 433.

⁴ *Ibid.* *op. supra cit.*

⁵ *Traité de Mat. Méd.* ii. 410.

⁶ *United States Dispensatory*.

a satisfactory proof that the cathartic principle of senna becomes absorbed, and is thrown out of the system by the excretories. Farthermore, as purging results from the injection of infusion of senna into the veins, this cathartic would appear to exercise a specific influence over the bowels, independent of its local action on these when it is swallowed.

USES.—Senna is well adapted for those cases which require an active and certain purgative, with a moderate stimulus to the abdominal and pelvic viscera. Thus, *in constipation and inactivity of the alimentary canal*, requiring the continued or frequent use of purgatives; *in worms*; *in determination of blood to the head*, and many other cases which readily suggest themselves, senna answers very well. The circumstances contraindicating its use are, an inflammatory condition of the alimentary canal, a tendency to hemorrhoids or menorrhagia, threatening abortion, and prolapsus of the uterus and rectum. The objections to its use are, the large dose required, the nauseous and disgusting flavour, the tendency to gripe, and the irritant and stimulant operation. Thus, in inflammation of the mucous membrane of the bowels, the irritant action of senna makes it an objectionable purgative; while its tendency to increase the frequency of the pulse renders it less fit for exhibition in febrile disorder than the saline purgatives. It is a very safe purgative, and may be given to children, females, and elderly persons, with great security. Though it is not the most appropriate purgative to be employed after delivery, and operations about the abdomen or pelvis (as hernia and lithotomy), yet I have repeatedly seen it used, and rarely with any unpleasant consequences.

ADMINISTRATION.—Powder of senna may be given in doses of from ʒss to ʒij for adults. There are two objections to its use, the great bulk of the necessary dose, and the uncertainty of its operation, arising from its liability to decompose by keeping. To cover the unpleasant flavour of senna, Dr. Paris¹ recommends the addition of Bohea (black) tea; coffee has been advised by others. Aromatics (especially coriander and ginger) are frequently added to prevent griping, and to improve the flavour.

1. INFUSUM SENNÆ, E. [U. S.]; *Infusum Sennæ Compositum*, L. D.; *Infusion of Senna*; *Senna Tea*.—(Senna Leaves ʒxv [ʒiiss, E.; ʒss, D.]; Ginger, bruised, ʒiv [ʒss, D.]; Boiling [distilled, L.] Water Oj.)—Macerate for an hour in a vessel lightly covered, and strain [through linen or calico, E.].—[The U. S. Pharm. directs Senna ʒj; Coriander, bruised, ʒj; Boiling Water Oj.] An ordinarily used purgative, employed frequently in the maladies of children as well as of adults. A saline purgative (sulphate of magnesia or of soda, or potash-tartrate of soda, or tartrate of potash) is usually given in conjunction with it; manna and tincture of senna being frequently added. A compound of this kind is called the *black draught*.—The dose of infusion of senna is from fʒij to fʒiv for adults. [In order to preserve this infusion in warm weather, Mr. Squire recommends the addition of one grain of nitrate of potash to each ounce.—ED.]

2. INFUSUM SENNÆ COMPOSITUM, E.; *Compound Infusion of Senna*.—(Senna ʒj; Tamarinds ʒj; Coriander, bruised, ʒj; Muscovado Brown Sugar ʒss; Boiling Water fʒviij. Infuse for four hours, with occasional stirring, in a covered vessel, not glazed with lead; and then strain through linen or calico. This infusion may be likewise made with twice or thrice the prescribed quantity of senna.)—A vessel not glazed with lead is directed, lest the acid of the tamarinds should dissolve the metal of the glazing, and thereby give a noxious impregnation. This cathartic somewhat resembles Sydenham's *potio cathartica lenitiva*. The unpleasant flavour of the senna is agreeably covered by the tamarinds and sugar. This preparation is cathartic and refrigerant. It is employed as a cathartic in febrile disorders.—Dose, fʒij to fʒiv.

3. ENEMA CATHARTICUM, E. D.; *Cathartic Enema*.—(Olive Oil ʒj; Sulphate of

¹ *Pharmacologia*.

Magnesia \mathfrak{zss} ; Sugar \mathfrak{zj} ; Senna \mathfrak{zss} ; Boiling Water $\mathfrak{f}\mathfrak{z}\mathfrak{x}\mathfrak{vj}$. Infuse the senna for an hour in the water, then dissolve the salt and sugar; add the oil, and mix them by agitation, *E*.—The *Dublin College* employs of Olive Oil $\mathfrak{f}\mathfrak{z}\mathfrak{j}$; Sulphate of Magnesia $\mathfrak{z}\mathfrak{j}$; Mucilage of Barley $\mathfrak{f}\mathfrak{z}\mathfrak{x}\mathfrak{vj}$. Dissolve the sulphate of magnesia in the mucilage; add the oil, and mix.)—Employed as a laxative. It is a constituent of the fetid elyster.

4. *TINCTURA SENNÆ COMPOSITA*, L. E. D.; *Tincture of Senna*; *Elixir Salutis* [*Tinctura Sennæ et Jalapæ*, U. S.].—(Senna Leaves $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{i}\mathfrak{s}\mathfrak{s}$; Caraway Seeds, bruised, $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{i}\mathfrak{s}\mathfrak{s}$; Cardamoms, bruised, $\mathfrak{z}\mathfrak{j}$; Raisins [stoned] $\mathfrak{z}\mathfrak{v}$; Proof Spirit Oij. Macerate for seven days, and then press and strain, *L*.—Senna $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Caraway Seeds, bruised; Cardamom Seeds, bruised, of each \mathfrak{zss} ; Proof Spirit Oij. Macerate for fourteen days, strain, express, and filter, *D*.—Sugar $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{s}\mathfrak{s}$; Coriander, bruised, $\mathfrak{z}\mathfrak{j}$; Jalap, in moderately fine powder, $\mathfrak{z}\mathfrak{v}\mathfrak{j}$; Senna $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Caraway, bruised; Cardamom seeds, bruised, of each $\mathfrak{z}\mathfrak{v}$; Raisins, bruised, $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Proof Spirit Oij. Digest for seven days, strain the liquor, express strongly the liquor, and filter the liquids. This tincture may be more conveniently and expeditiously prepared by percolation, as directed for the compound tincture of cardamom. If Alexandrian Senna be used for this preparation, it must be freed from *Cynanchum* [Argel] leaves by picking, *E*.)—[The following is the formula of the *U. S. Pharmacopœia*: Take of Senna $\mathfrak{z}\mathfrak{i}\mathfrak{j}$; Jalap, in powder, $\mathfrak{z}\mathfrak{j}$; Coriander, bruised; Caraway, bruised, of each half an ounce; Cardamom, bruised, $\mathfrak{z}\mathfrak{i}\mathfrak{j}$; Sugar $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Diluted Alcohol Oij. Macerate for fourteen days, express, and filter through paper. This tincture may also be prepared by beating well together the senna, jalap, sugar, and aromatics, moistening them thoroughly with Diluted Alcohol, allowing them to stand forty-eight hours, then transferring them to a percolator, and gradually pouring upon them Diluted Alcohol until three pints of filtered liquor are obtained.]—Carminative, cordial, stomachic, and purgative. Usually employed as an adjunct to the infusion of senna. If given alone as a purgative, the dose should be $\mathfrak{f}\mathfrak{zss}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{j}$. It is useful in costiveness attended with flatulence.

5. *SYRUPUS SENNÆ*, L. E. [U. S.]; *Syrup of Senna*.—(Senna $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}\mathfrak{s}\mathfrak{s}$; Fennel (seed), bruised, $\mathfrak{z}\mathfrak{x}$; Manna $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$; Treacle $\mathfrak{h}\mathfrak{i}\mathfrak{i}\mathfrak{j}$; Boiling Distilled Water Oj. Macerate the senna and fennel in the water, with a gentle heat, for six hours. Mix the manna and treacle with the strained liquor; then boil down to a proper consistence, *L*.—Senna $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Boiling Water Oj and $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Treacle $\mathfrak{z}\mathfrak{x}\mathfrak{l}\mathfrak{v}\mathfrak{i}\mathfrak{i}\mathfrak{j}$. Infuse the senna in the water for twelve hours; strain, and express strongly through calico, so as to obtain a pint and two fluidounces at least of liquid. Concentrate the treacle in the vapour-bath as far as possible, or till a little taken out upon a rod becomes nearly concrete on cooling; and, while the liquor is still hot, add the infusion, stirring carefully, and removing the vessel from the vapour-bath as soon as the mixture is complete. If Alexandrian Senna be used for this preparation, it must be carefully freed of *Cynanchum* [Argel] leaves by picking it, *E*.)—[Take of Senna $\mathfrak{z}\mathfrak{i}\mathfrak{j}$; Fennel Seed, bruised, $\mathfrak{z}\mathfrak{j}$; Boiling Water Oj; Sugar $\mathfrak{z}\mathfrak{x}\mathfrak{v}$. Digest the Senna and Fennel Seed in the water with a gentle heat, for an hour, then strain, add the sugar, and evaporate to the proper consistence.]—Cathartic. Given to children in doses of $\mathfrak{f}\mathfrak{z}\mathfrak{j}$ to $\mathfrak{f}\mathfrak{z}\mathfrak{i}\mathfrak{j}$.

6. *CONFECTIO SENNÆ*, L. D. [U. S.]; *Electuarium Sennæ*, E.; *Electuarium Lenitivum*; *Confection of Senna*; *Lenitive Electuary*.—(Senna $\mathfrak{z}\mathfrak{v}\mathfrak{i}\mathfrak{i}\mathfrak{j}$; Figs $\mathfrak{h}\mathfrak{z}\mathfrak{j}$; Prepared Tamarinds; Prepared Cassia; Prepared Prunes, of each $\mathfrak{h}\mathfrak{ss}$; Coriander $\mathfrak{z}\mathfrak{i}\mathfrak{v}$; Fresh Liquorice, bruised, $\mathfrak{z}\mathfrak{i}\mathfrak{i}\mathfrak{j}$; Sugar $\mathfrak{h}\mathfrak{i}\mathfrak{i}\mathfrak{s}\mathfrak{s}$; Distilled Water Oij. [Water Oiv, U. S.] Rub the senna with the coriander, and by a sieve separate ten ounces of the mixed powder; then boil down the water, with the figs and liquorice added, to half, then express and strain. Evaporate the strained liquor in a water-bath, until, of the whole, twenty-four fluidounces remain; then, the sugar being added, let a syrup be made. Lastly, gradually rub the pulps with the syrup, and having

thrown in the sifted powder, mix them all, *L.*—The *Edinburgh College* omits the Tamarind and Cassia pulps, but employs ℥j of Prune pulp, and Oij½ of Water. —The *Dublin College* directs Senna Leaves, in a very fine powder, ℥ij; Coriander, in fine powder, ℥j; Oil of Caraway ℥ss; Pulp of Prunes ℥v; Pulp of Tamarinds ℥ij; Brown Sugar ℥vij; Water f℥ij. Dissolve the sugar in the water, and beat the pulps with the syrup to a uniform consistence; having stirred in the powders and oil of caraway, mix all well together, and heat the mass thoroughly in a water-bath for ten minutes.)—The preparation of this compound being troublesome and expensive, and sophistications of it not being readily detectable, it is rarely prepared, in commerce, as directed by the London and Edinburgh Colleges. Jalap is frequently substituted, partially or wholly, for the senna and cassia pulp. Dr. Paris mentions walnut liquor as a colouring ingredient in use; and adds, that a considerable quantity of this confection is made in Staffordshire, in which unsound and spoilt apples enter as a principal ingredient. When properly prepared, it is a pleasant, mild, and very effectual purgative, and is frequently employed by pregnant women, persons afflicted with hemorrhoids or diseases of the rectum. When given alone in a full dose it is apt to gripe. Dose, ℥j to ℥vj. It is frequently employed as a vehicle for the exhibition of other cathartics; for example, bitartrate of potash.

[7. EXTRACTUM SENNÆ FLUIDUM, U. S.; *Fluid Extract of Senna*.—(Take of Senna, in coarse powder, ℥ijss; Sugar ℥xx; Oil of Fennel f℥i; Compound Spirit of Ether f℥ij; Diluted Alcohol Oiv. Mix the senna with the diluted alcohol, and having allowed the mixture to stand for twenty-four hours, introduce it into a percolator, and gradually pour in water mixed with one-third of its bulk of alcohol, until a gallon and a half of liquid shall have passed. Evaporate the liquid by means of a water-bath to twenty fluidounces, filter, then add the sugar, and, when it is dissolved, the compound spirit of ether holding the oil of fennel in solution.) This is a concentrated preparation of senna, convenient in consequence of the smallness of the dose, which is f℥j—ij. It may be given by itself or in combination, as the infusion.]

284. CASSIA FISTULA, *Linn. L. E. D.*—THE PUDDING-PIPE TREE, OR PURGING CASSIA.

Cathartocarpus Fistula, *Persoon*.

Sex. Syst. Decandria, Monogynia.

(Fructus, *L.*—Pulp of the pods, *E.*)

HISTORY.—The earliest writers, in whose works we find the fruit of Cassia Fistula mentioned, are the Arabians, Mesue, Serapion, and Avicenna. The first Greek writer who notices it is Actuarius, who terms it κασσία μελαινα, or *black cassia*.¹

BOTANY. **Gen. Char.**—See *Cassia* (p. 844).

Sp. Char.—*Leaflets* 4 to 6 pairs, ovate, somewhat acuminate, smooth; *petioles* glandless. *Racemes* lax, without bracts. *Legumes* terete; straight, somewhat obtuse, smooth. (De Cand.)

Tree from 20 to 30 feet high. *Leaves* alternate, pinnate, from 12 to 18 inches long; *leaflets* from 2 to 6 inches long, and from 1 and a half to 3 inches broad. *Stipules* minute. *Racemes* 1 to 2 feet long. *Flowers* large, bright-yellow, fragrant, on long foot-stalks. *Legume* cylindrical, ligneous, 1 or 2 feet long, externally blackish-brown; with three longitudinal bands or seams extending the whole length, two of which, by their contiguity, appear to form a single one, the third being on the opposite side of the legume; internally divided into numerous cells by thin transverse partitions or phragmata, formed by the distension of the placenta, and therefore called spurious dissepiments. *Seed* 1 in each cell, surrounded by a soft

¹ Lib. v.

blackish pulp, which appears to be a secretion of the endocarp or inner coat of the pod.

Hab.—East Indies, Egypt. Introduced into the West Indies.

DESCRIPTION.—The pods of *Cassia Fistula* (*cassia fistula*; *legumen cassiæ fistulæ*) are imported from the East Indies (Madras and Ceylon), from the West Indies (Barbadoes), and from South America (Carthagenia and Savanilla). Their botanical description has been above given. Their *pulp* (*pulpa cassiæ fistulæ*; *pulpa leguminis cassiæ fistulæ*) is reddish-black, with a sweetish taste. By exposure to the air it becomes acid, in consequence of undergoing the acetous fermentation. Those pods yield the most pulp which are heavy, and do not rattle when shaken.

SMALL AMERICAN CASSIA FISTULA; Petite Casse d'Amérique, Guibourt.—Pods twelve to eighteen inches long, and six lines in diameter, pointed at the extremities. *Pericarp* thinner than the ordinary *Cassia fistula*. *Pulp* reddish-brown, acerb, astringent, sweet. Is this pod the fruit of *Cathartocarpus bacillaris*, a native of the Caribæan Islands, depicted in Jacquin's *Fragm. Bot. Tab. 85*?

The pulp of *CASSIA BRASILIANA* has been employed in America. The pods are from 18 to 24 inches long, ligneous, and rough, with very prominent sutures.

COMPOSITION.—Vauquelin¹ and N. E. Henry² have analyzed *Cassia pulp*.

Vauquelin's Analysis.		N. E. Henry's Analysis.		
Pericarp	35.15	Sugar	Common or African.	American.
Phragmata	7.03		61.00	69.25
Seeds	13.28	Gum	6.75	2.60
{ Sugar	14.85	Matter possessing many properties	13.25 traces small quantity 19.00	3.90 traces none 24.25
{ Gum	1.56	of tanning substances		
{ Extractive	0.51	Do. having some properties of gluten		
Pulp { Vegetable jelly	0.13	Colouring matter soluble in ether .		
{ Glutinous matter	0.79	Loss, principally owing to water .		
{ Woody fibre	2.35			
{ Water	21.35			
Cassia pods	97.00	Watery extract of Cassia pulp	100.00	100.00

PHYSIOLOGICAL EFFECTS.—*Cassia pulp* in small doses is a mild laxative; in large doses a purgative; but it is apt to occasion nausea, flatulence, and griping. Manna is said singularly to exalt the purgative effect of *Cassia pulp*.³ Thus Valisnieri states, that twelve drachms of this pulp are about equivalent in purgative strength to four ounces of manna; but that if we give eight drachms of *Cassia pulp*, in combination with four drachms of manna, we obtain double the effect! But the correctness of such a statement is not supported by any evidence yet adduced.

USES.—It is rarely or never given alone; but the cases for which it is well adapted are febrile and inflammatory affections. On account of its pleasant taste it would be a convenient purgative for children.

ADMINISTRATION.—Dose, for an adult, of the pulp, as a mild laxative, \mathfrak{zj} to \mathfrak{zij} ; as a purgative, \mathfrak{zj} to \mathfrak{zij} .

1. **CASSIA PREPARATA, L.**—(*Cassia*, broken lengthwise, \mathfrak{Hj} ; Distilled Water sufficient to cover the *Cassia*. Macerate for six hours, occasionally stirring; strain the softened pulp through a hair sieve, and evaporate to the consistence of a confection by a water-bath.—**Ed.**)

2. **CONFECTIO CASSIÆ, L.; Confection of Cassia.**—(Prepared *Cassia* \mathfrak{Hss} ; Manna \mathfrak{zij} ; Prepared Tamarind Pulp \mathfrak{zj} ; Syrup of Rose $\mathfrak{f\mathfrak{z}vii\mathfrak{j}}$. Bruise the Manna, then dissolve it in the Syrup; afterwards mix in the *Cassia* and Tamarind pulps, and evaporate the moisture until a proper consistence is attained.)—Laxative. Occasionally used for children, as a vehicle for some more active substance.—Dose \mathfrak{zij} . to \mathfrak{zj} . for adults.

¹ *Ann. de Chim.* vi. 275.

² See Paris, *l'arm.* 6th edit. i. 271.

³ *Journ. de Chim. Méd.* ii. 370.

285. COPAIFERA MULTIJUGA, Hayne, L.—VARIOUS SPECIES, D. E.

Copaifera multijuga et aliæ species, *De Cand.*—*Copaifera officinalis*, *Linn.*

Sex. Syst. Decandria, Monogynia.

(Oleo-resina, *L. D.*—Fluid resinous exudation, *E.*—Copaiba, *U. S.*)

HISTORY.—The first notice of Copaiva balsam, as well as of the tree yielding it, was given by Piso.¹ Hayne² is of opinion that the *Copaifera bijuga* is the species observed by Piso.

BOTANY. **Gen. Char.**—*Calyx* ebracteolate, of 4 spreading, small, equal sepals united at the base. *Petals* 0. *Stamens* 10, distinct, nearly equal; *anthers* oblong. *Style* filiform. *Legume* stalked, obliquely elliptical, coriaceous, somewhat compressed, 2-valved, with 2 ovules, 1-seeded. *Seed* elliptical, inclosed in a baccate aril. *Embryo* straight; *radicle* somewhat lateral.—*Trees.* *Leaves* abruptly pinnate. *Leaflets* coriaceous, somewhat unequal, ovate. *Flowers* paniculate. (*De Cand.*)

Species.—1. *C. MULTIJUGA*, Hayne, L.—*Leaflets* 6 to 10 pairs, ovate-lanceolate, acuminate, mucronate, with pellucid dots. *Petiole* slightly hairy. In the province of Para the greatest quantity of the balsam is furnished by this species (Hayne).

2. *C. LANGSDORFII*, Desf. L.—*Leaflets* 3 to 5 pairs, ovate or oval, blunt, equal-sided, with pellucid dots. *Petioles* and *peduncles* slightly downy.—This and the following species furnish the balsam collected by the natives of Santa Paulo.

3. *C. CORIACEA*, Mart.—*Leaflets* 2 to 3 pairs, elliptical, equal-sided, emarginate, coriaceous, not dotted, reticulated, smooth on both sides, somewhat glaucous beneath. *Petioles* and *peduncles* almost smooth.—Bahia. It yields balsam of copaiva in Santa Paulo.

4. *C. OFFICINALIS*, Linn. D.; *C. Jacquini*, Desf.—*Leaflets* 2 to 5 pairs, incurved, ovate, unequal-sided, obtusely acuminate, with pellucid dots. Venezuela, near Calaboso, West Indies. An inferior kind of balsam is said to be obtained from this species.

The following are species of *Copaifera* described by Hayne:—

5. *C. BEYRICHI*, Hayne.—Mandiocca, in the Brazils.
6. *C. GUIANENSIS*, Desf.—Guiana, near Rio Negro.
7. *C. MARTII*, Hayne.—Para.
8. *C. BIJUGA*, Willd.—Brazils.
9. *C. JUSSIETII*, Hayne.—Brazils.
10. *C. NITIDA*, Mart.—Brazils (Minas Geraes).
11. *C. LAXA*, Hayne.—Brazils.
12. *C. CORDIFOLIA*, Hayne.—Brazils.
13. *C. SELLOWII*, Hayne.—Brazils.
14. *C. OBLONGIFOLIA*, Mart.—Brazils (Minas Geraes).

EXTRACTION OF THE BALSAM.—The balsam is obtained by making incisions³ into the stems of the trees. It exudes so abundantly that, at the proper season, twelve pounds are sometimes obtained in the space of three hours.³ If, however, no balsam should flow, the wound is immediately closed with wax or clay, and re-opened in a fortnight, when an abundant discharge takes place. Old trees sometimes furnish balsam two or three times in the year. Langsdorff,⁴ in his account of Santa Catherina, observes that “the tree which yields copaiva balsam, or balsam of Tolu, *Copaifera officinalis*, is here called *oleo breto*, or black olive. It abounds in the forests, but very little use is made of it. I was assured, that when the incision is made in the tree to procure the balsam, which is done only in the very hot summer months, a strong sound is heard, and the sap or balsam rushes out in a stream, as when a vein is opened in the human arm.”

¹ *Med. Bras.* lib. iv. cap. 4; in *Hist. Nat. Bras.* Lugd. 1648.

² Duncan, *Suppl. to the Edinb. New Disp.* p. 45.

³ Piso, *op. supra cit.* p. 56.

⁴ *Voyages and Travels in Various Parts of the World, during the Years 1803—1807*, pp. 43, Lond. 1813.

COMMERCE.—Balsam of Copaiva is principally obtained from Para and Maranham. This probably is yielded, for the most part, by *C. multijuga*, the tree assigned in the London Pharmacopœia. Carthagena, Maracaibo, and Savanilla also furnish some. Is this from *C. officinalis*? Occasionally it is brought from Rio Janeiro, and is there probably procured from *C. Langsdorffii* and *coriacea*. Some is imported from the West Indies; and a considerable quantity, at second hand, from New York. It is usually brought over in casks holding one cwt. or one and a half cwt. In 1839, duty (4s. per cwt.) was paid on 643 cwt.

DESCRIPTION.—Balsam of Copaiva (*Balsam Copaivæ*, seu *Copaibæ*) is a clear transparent liquid, having for the most part the consistence of olive oil. It has a pale yellowish colour, a peculiar, not disagreeable odour, and a bitter, somewhat acrid and nauseous taste. Its sp. gr. is less than that of water, but is not constant. It is 0.95 according to Schönberg, while Stoltze says it is 0.966. By keeping, it becomes considerably denser, owing to the loss of volatile oil. Balsam of copaiva is insoluble in water, but is completely soluble in alcohol, ether, and the oils, both fixed and volatile. When acted on by alkalies it yields a kind of soap, which is insoluble in water.

Considerable variation exists in the colour, consistence, and sp. gr. of, as well as in the relative quantities of volatile oil and resin yielded by, balsam of copaiva. Even the odour and taste vary somewhat. The differences doubtless depend in great part upon the balsam being procured from different species. The smaller species, which grow in the interior of the Brazils, as in Bahia and Minas, yield, as we are told, less balsam, but it is more resinous and sharper. *Brazilian Copaiva* is thin, clear, and pale-coloured. *West Indian Copaiva* (produced probably by *C. officinalis*) is thick, golden-yellow, not transparent, and has a less agreeable smell, which is somewhat like that of turpentine. [It is to be regretted that the term balsam is still erroneously applied to this liquid. The London College has more correctly described it as an oleo-resin; it is in fact resin dissolved in essential or volatile oil, like ordinary turpentine. It contains no benzoic acid, which has generally been regarded by pharmacologists as a necessary constituent of a substance to which the term balsam is applied.—Ed.]

ADULTERATION.—There is no reason to suppose that balsam of copaiva is adulterated in this country now; though the following fact, mentioned by Dr. Paris,¹ proves that formerly it was. "A curious trial took place some time since, between the owners of certain premises that were burnt down, and the Governors of the Sun Fire-Office, in consequence of the latter refusing to indemnify the proprietor for his loss, because the fire had been occasioned by his making Balsam of Copaiba."—Gray² has published formulæ for making a *balsamum copaibæ reductum*, as well as *copaiba factitia*.—The *Edinburgh College* gives the following characters of the purity of the Balsam:—

"Transparent; free of turpentine odour when heated; soluble in two parts of alcohol; it dissolves a fourth of its weight of carbonate of magnesia, with the aid of a gentle heat, and continues translucent."

The turpentine odour may be recognized by dropping the suspected balsam on a heated iron (as a spatula). The mixture of magnesia and copaiva here referred to, acquires, in several hours, the translucency, aspect, and consistency of very thick mucilage of gum Arabic. This test was proposed by Blondeau.³ If one or two drops of suspected balsam be placed on unsized paper, and carefully heated over a lamp to expel the volatile oil, an homogeneous translucent spot is left, if the balsam be pure; but if it have been mixed with castor-oil, the spot of resin is surrounded by an oily areola.⁴ Planche⁵ has recommended ammonia as a test. If pure balsam be shaken with liquor ammoniæ (sp. gr. 0.965), it becomes clear and transparent in a few instants; not so when castor-oil is present. Ebullition with water (to expel the volatile oil and obtain the hard resin), and the action of potash, and of sulphuric acid, have also been proposed as tests.

¹ *Pharmacologia*, 6th edit. ii. 183.

² *Journ. de Chim. Méd.* i. 560; and ii. 41.

³ *Journ. de Pharm.* xi. 228.

⁴ *Suppl. to the Pharm.*

⁵ Chevallier, *Journ. de Chim. Méd.* iv. 619.

Figs. 370—381.



COMPOSITION.—F. Hoffmann¹ submitted copaiva to a chemical examination. Afterwards Schönberg² analyzed it. In 1826, Stoltze,³ and, in 1829, Gerber,⁴ submitted it to analysis.

Stoltze's Analysis.

Volatile oil	38.00
Yellow dark resin (<i>copaivic acid</i>)	52.75
Brown soft resin	1.66
Water and loss	7.59
Balsam of Copaiva	100.00

Gerber's Analysis.

Fresh Balsam.	Old Balsam.
41	31.70
51.38	53.68
2.18	11.15
5.44	4.10
100.00	100.63

1. VOLATILE OIL (see post).

2. RESIN OF COPAIVA (*Resina Copaihæ*).—After the balsam has been deprived of its volatile oil by distillation, a brownish resinous mass is left behind. This, when gently heated to expel the residual water, is sold as *resin of copaiva*. It consists of two resins—one called *copaivic acid*, the other the *viscid resin of copaiva*. They are separated by rectified spirit, which dissolves the acid resin, but leaves the viscid one.

a. Copaivic Acid; Yellow Brittle Resin of Copaiva.—One hundred parts of balsam yield, on an average, fifty parts of this acid. Copaivic acid is an amber coloured, brittle, crystallizable resin, soluble in alcohol, rectified spirit, ether, and the volatile and fixed oils. It is decomposed by sulphuric and nitric acids. Its acid properties are proved by its alcoholic solution reddening litmus, and by the definite compounds (*copaivates*) which it forms with bases. Thus, if an alcoholic solution of nitrate of silver be dropped into the alcoholic solution of this resin, we obtain, on the addition of a little ammonia, a white crystalline precipitate (*copaivate of silver*) slightly soluble in alcohol, and composed of one atom copaivic acid, and one atom oxide of silver. In the same way we may form the analogous *copaivates of lead and lime*. The *copaivates of potash and soda* are soluble, and have a bitter taste and a disagreeable odour; they are easily decomposed by acids. The *copaivate of ammonia* is soluble in ether and alcohol, but not in water. The *copaivate of magnesia* is prepared by adding copaivate of potash to sulphate of magnesia.

Copaivic acid is isomeric with pinic acid; that is, its composition is $C^{40}H^{32}O^4$ (Rose).

β. Viscid Resin of Copaiva; Brown Soft Resin of Copaiva.—When a hot alcoholic solution of copaiva cools, it retains in solution the acid resin already described, but deposits a brown viscid substance, which is termed the *viscid resin of copaiva*. As it is more abundant in old than in recent balsam, Gerber regards it as produced by some alteration of the acid resin. It is soluble in anhydrous alcohol and ether, and in the volatile and fixed oils. It has very little affinity for basic substances. One hundred parts of balsam contain from 1.65 to 2.13 per cent. of this resin.

PHYSIOLOGICAL EFFECTS.—Copaiva produces the general and topical stimulant effects of the oleo-resins, already described. Taken in *moderate* doses, it creates a sensation of warmth in the stomach, gives rise to eructations having the odour of the balsam, and not unfrequently occasions nausea, or even actual vomiting. The continued use of it often impairs the appetite, and disorders the digestive functions. These may be regarded as the local effects on the stomach. The constitutional effects, or those which result from the absorption of the balsam, or of its active constituent, the oil, are those of a stimulant whose influence is principally directed to the secreting organs, more especially to the mucous membranes and to the urino-genital apparatus. The oil passes out of the system in part by the lungs, and the odour of its vapour is readily detectable in the breath of persons taking it. The urine is increased in quantity and altered in quality; thus its colour is heightened, its odour becomes balsamic, and its taste bitter; moreover, not unfrequently it is turbid, as if containing mucus.

[It has been proved that the oleo-resinous matter of copaiva enters the urine, and causes the secretion to stimulate an albuminous condition, inasmuch as it becomes precipitable by nitric acid. It is important to remember this in a pathological point of view. The precipitate may be distinguished from that of albumen by the fact of its not subsiding as albumen does after the fluid has been set aside for a few hours.⁵—ED.]

¹ *Obs. Phys. Chym.* lib. i. obs. 6; *Op. omn.* iv. 454, Gen. 1748.

² *Berl. Jahrb.* xxvii. 2. 179.

³ *Pfaff, Mat. Med.* iv. 12.

⁴ *Journ. de Pharm.* xvi. 79 and 367.

⁵ *Rees On the Analysis and Treatment of Urinary Diseases*, p. 204.

The influence of copaiva over the mucous membrane lining the urethra, is shown, even in the healthy state, by the warmth and tickling sometimes experienced in this part, both before and after evacuating the urine, as observed by König, a medical student,¹ in his experiments with this medicine; and also by the marked influence which the balsam has in mucous discharges from this membrane—an influence familiar to every tyro in medicine. Farthermore, it is said occasionally to have produced unpleasant irritation of the testicles, though I have never observed this. It also acts as a stimulant, but in a less marked manner, to other mucous membranes; namely, the bronchial and gastro-intestinal membranes. The greater influence of copaiva over the urethral than over other mucous membranes is by some explained thus: besides the influence which this receives in common with the other membranes of the same class, by the general circulation, it is exposed to the local action of copaiva contained in the urine as this fluid is expelled from the bladder. If this hypothesis were correct, the influence of copaiva over the mucous lining of the bladder would be greater than that over the urethral membrane. Not unfrequently it gives rise to an eruption, usually of a scarlet colour, referable to either urticaria or erythema, though some describe it as being milary. Vesicular eruptions are also spoken of, but I have never seen them. Mr. Judd² has depicted two eruptions caused by the balsam: one he calls *small puniceous patch eruptions*; the other was a *popular eruption*. Rheumatism has also been ascribed to the use of the balsam.³

Large doses of copaiva irritate the gastro-intestinal canal, and occasion a sensation of heat at the pit of the stomach, nausea, vomiting, loss of appetite, and purging, with, not unfrequently, griping pains of the bowels. The whole system becomes powerfully stimulated; the pulse is fuller and more frequent, the skin hotter, and thirst and headache are produced. Occasionally, hæmaturia and dangerous ischuria are brought on. "I saw," says Kraus,⁴ "a very dangerous case, of thirty-six hours' standing, almost instantaneously relieved by the application of a warm poultice (made of four ounces of the hyoscyamus plant) over the genital organs." The same author also says that the repeated use of large doses occasions, "in young marriageable subjects, a measles-like eruption over the whole body, which I have many times seen treated by pretended great diagnosticians (*Diagnostikern*) as true measles."

In one case⁵ pain at the stomach, general uneasiness, and epileptic convulsions, followed, and were ascribed to the use of copaiva. But the correctness of ascribing the convulsions to the use of the copaiva appears very doubtful.

When we compare the operation of copaiva with that of other agents possessing powers of a somewhat similar kind, we observe that both in local and constitutional effects it is more powerful than the balsams properly so called (that is, the native oleo-resins which contain benzoic acid), while its operation on the urino-genital organs is much more marked. It forms an intermediate substance between the balsams and the turpentine, being less powerful, but more aromatic, than the latter; yet, observes Ribes,⁶ the turpentine is less successful in gonorrhœa. The same author considers it to be less powerful than balsam of Mecca, but more so than balsam of Canada.

USES.—The principal employment of copaiva is in *mucous discharges from the urino-genital organs*, more especially in gonorrhœa. There are two methods of treating this disease by copaiva; one is, not to exhibit the balsam until the inflammatory symptoms have subsided—the other is to give it at the very outset, in order to cut short or suppress the disease.

The *first* method is that followed by the best English and German surgeons. It consists in employing, during the violence of the inflammatory stage, antiphlogistic

¹ Wibmer, *Wirk. d. Arzneim. u. Gifte*, i. 484. ² *Pract. Treat. on Urethritis and Syphilis*, Lond. 1836.

³ *Brit. and For. Med. Rev.* viii. 280; and *Lancet*, vol. ii. for 1837—s. p. 826.

⁴ *Heilmittellehre*, 621, Gött. 1831.

⁵ *Brit. and For. Med. Rev.* ix. 270.

⁶ Quoted by Bayle, *Bibl. Thérap.* i. 363.

and soothing measures; and when the inflammation has quite or nearly subsided, or is of a very mild character, giving copaiva with the view of diminishing or stopping the discharge. This is the plan recommended by Hunter,¹ and the same practice is recommended in the published lectures of Sir Astley Cooper² and Mr. Lawrence.³ It is undoubtedly the safest method of treatment; for although copaiva may sometimes, or even frequently, be exhibited during the acute or inflammatory stage of gonorrhœa, not only with impunity, but even with advantage, there is no denying the fact that it has, occasionally at least, aggravated the symptoms. This, indeed, is admitted by Ansiaux,⁴ one of the principal supporters of the other plan of treatment. Many practitioners judge of the propriety of exhibiting the balsam by the quality of the discharge only, and refrain from administering this medicine until the discharge has acquired what is called a gleet character. I believe most prudent surgeons consider the existence of much pain or scalding in passing the water, an irritable condition of bladder, or violent chordee, as contraindicating the use of copaiva; while the absence of these symptoms may be regarded as permitting or indicating it.

The *second* method of treating gonorrhœa by copaiva, consists in exhibiting this medicine in large doses at the commencement of the disease; that is, in its acute stage, usually without adopting any preliminary antiphlogistic or soothing measures. In America, the practice is not new; but in Europe, it has been recommended or adopted to any extent only since the commencement of the present century, and principally by the recommendations of Ansiaux, Ribes, and Delpêch.⁵

Ansiaux candidly admits that, in some cases, the practice has been injurious; in one instance he saw it produce acute pain, irritable bladder, and discharge of blood by the urethra. The second of these writers seems to regard copaiva as a specific for gonorrhœa and all its consequences, including swelled testicle, dysury, ischury, cystitis, nephritis, &c. ! Delpêch speaks of its use in a much more guarded manner; he employs leeches, and the usual antiphlogistic measures, when the inflammatory symptoms are very severe; but when the inflammation is not excessive, he commences at once with the balsam. In fact, his practice approximates very much to that usually followed in this country and Germany. The partisans of this second method of treating gonorrhœa say, that both copaiva and cubebs cure more easily and promptly, and with less chance of relapse, the sooner they are exhibited after the commencement of the disease; in other words, old claps are less readily cured by them than recent ones.

It has been stated by Delpêch and Ricord—and I believe the experience of most practitioners bears out their statement—that copaiva is less successful in the gonorrhœa of females than in that of males. Trousseau and Pidoux⁶ have endeavoured to account for this by saying that, in the female, gonorrhœa is not confined to the mucous lining of the urethra (on which the influence of copaiva is principally exercised), but extends to that of the vagina.

Velpeau⁷ employs lavements of the balsam in gonorrhœa. By this mode of exhibition, the nausea and vomiting which copaiva is apt to occasion, when taken by the mouth, are entirely obviated. Velpeau asserts, that by this mode of administration, blennorrhagic discharges of both males and females are almost always diminished, and frequently completely stopped. He found the same practice useful in non-venereal puriform discharges from other mucous membranes. Indeed, he asserts that copaiva lavements may in all cases be substituted for the administration of this liquid by the mouth.

In *chronic inflammation of the bladder* (commonly termed *cystirrhœa* or *catarrhus vesicæ*), copaiva has at times been found beneficial.⁸ Delpêch relates a case of *acute vesical catarrh* cured by it. But *catarrhus vesicæ* is for the most part accom-

¹ *Treat. on the Vener. Dis.*

² *Lancet*, iii. 199.

³ *Lond. Med. Gaz.* v. 813.

⁴ *Mém. sur le Traitement de la Blennorrh.*; quoted by Bayle, *op. supra cit.* 348.

⁵ Bayle, *op. supra cit.*

⁶ *Traité de Thérap.* i. 491.

⁷ *Rech. sur l'Emploi du Baume de Copahu.*

⁸ La Roche, *Amer. Journ. of the Med. Sciences*, xiv. 13.

panied with considerable irritation, which is in general greatly increased by stimulants like copaiva.

In *leucorrhœa*, copaiva has been employed with some advantage. Favourable reports of this practice have been published by Cuttlet and Lacombe,¹ Armstrong,² and others.

In *chronic pulmonary catarrh*, its employment has been spoken of favourably. Armstrong,³ Hallé, Bretonneau, and La Roche (quoted by Bayle), have borne testimony to its good effects. It is only adapted for chronic, or old-standing cases, and for torpid habits. Its stimulant influence is calculated to be very injurious where there is inflammation or febrile disorder. Dr. Fothergill⁴ has very properly reprobated the practice of administering it in pulmonary consumption, as recommended by Fuller and others.

In *chronic inflammation of the mucous membrane of the bowels*, especially of the colon and rectum, copaiva has been used.⁵ Dr. Cullen⁶ spoke favourably of its use in *hemorrhoids*. "I have learned from an empirical practitioner," he says, "that it gives relief in hemorrhoidal affections; and I have frequently employed it with success. For this purpose, it is to be given in doses of from 20 to 40 drops, properly mixed with powdered sugar, once or twice a day."

It was formerly employed as a *topical application* to wounds and ulcers.

ADMINISTRATION.—Dose, from gtt. xx to ʒj, or even more. It is sometimes taken on sugar, and this is said to be the most efficacious method of giving it, in affections of the urinary organs; but its nauseous taste is a great objection to its employment in this way. Some take it *swimming on half a wineglassful of water*, to which a few drops of some bitter tincture have been added. Many persons employ it in the form of *emulsion* (made with mucilage, yolk of egg, or alkalies). If mucilage be employed, it should not be very thick, otherwise it will not mix well. Spirit of nitric ether is frequently added to cover the unpleasant flavour. Opium is sometimes conjoined to counteract purging, and acids (especially the sulphuric) to check nausea. *Syrup of copaiva* (prepared by rubbing ʒiv of balsam with 32 grs. of calcined magnesia, and then adding 64 drops of oil of peppermint and 62 ozs. of simple syrup) has been recommended.⁷ Balsam of copaiva has also been taken in the form of *pills*; various powders (starch, gum, rhubarb, magnesia, &c.) being employed to give it a proper consistence. If magnesia be employed (as recommended by Mialhe), the copaivic acid unites with it, and thereby forms copavate of magnesia, which has considerable consistence, and absorbs the volatile oil. In some cases the balsam acquires, by magnesia, a pilular consistence; but frequently it does not become thicker than honey. Bordeaux turpentine also possesses the property of solidifying with magnesia. The following is a formula for *copaiva pills*:⁸ Balsam of Copaiva ʒj; Calcined Magnesia ʒvj or ʒvij (or common Carbonate of Magnesia ʒj). Several hours are frequently required to effect the solidification of the balsam.—Velpéau's *copaiva lavement* is thus prepared: Balsam of Copaiva ʒij; Yolk of one Egg; Distilled Water fʒvij. Make an emulsion, and to which add Tincture of Opium gtt. xx or gtt. xxx.

The *resin of copaiva*, which was much extolled a few years since,⁹ is the least active part of the balsam.

1. OLEUM COPAIBÆ, E. [U. S.]; *Essential Oil of Copaiva*.—(Copaiva ʒj; Water Oiss. Distil, preserving the water; when most of the water has passed over, heat it, return it into the still, and resume the distillation; repeat this process so long as a sensible quantity of oil passes over with the water.)—The directions of the *Edinburgh College* make the process of obtaining the oil a more operose one than it really is. Mr. Whipple informs me, that from 249 lbs. of balsam he obtained 128

¹ Bayle, *op. supra cit.*

² *Op. supra cit.*

³ La Roche, *Lond. Med. Gaz.* ii. 31, new series.

⁴ *Lond. Med. Gaz.* ii. 864 new series.

⁵ Thorn, *Observ. on the Treat. of Gonorrhœa by a New Prepar. from the Bals. of Copaiba*, 1827.

⁶ *Pract. Illustr. of the Scarlet Fever, &c.* 1818.

⁷ *Med. Obs. and Inq.* iv. 231.

⁸ *Mat. Med.*

⁹ Soubeiran, *Traité de Pharm.* i. 523.

lbs. of volatile oil and 120 lbs. of resin. Ader¹ has published a method for procuring the oil without distillation; but the process is more expensive, while the oil obtained by it is impure, owing to the presence of a little resinous soap.

When oil of copaiva has been rectified, and afterwards freed from water by digesting it on chloride of calcium, it has a specific gravity of 0.878. It is colourless, and has an acrid taste, and an aromatic, peculiar odour. Sulphuret of carbon and sulphuric ether dissolve it in all proportions; absolute alcohol dissolves two-fifths its weight of it; ordinary rectified spirit takes up less than this. Potassium may be preserved in it unchanged, showing the absence of oxygen. It dissolves sulphur, phosphorus, and iodine (by the latter it is coloured), and absorbs chlorine, with which it becomes turbid and viscid. When dropped on iodine, heat and hydriodic acid are suddenly produced.

Sulphuric and nitric acids convert it into a resinous substance. When hydrochloric acid gas is passed into this oil, crystals of the *hydrochlorate of the oil of copaiva* (or *artificial camphor of the oil of copaiva*) are deposited, while a fuming oily product, saturated with acid, remains. Hence, therefore, it is probable that oil of copaiva, like the oil of turpentine, consists of at least two isomeric oils; one, which forms the crystallizable compound with hydrochloric acid; the other, which does not form this crystalline matter.

Oil of copaiva is isomeric with oil of turpentine—that is, it consists of $C^{10}H^8$.

For medicinal use, I prefer the oil of copaiva to any other preparation of the balsam. The usual dose is from ten to twenty drops, which may be gradually increased; but I have known ζj taken at one dose without any ill effects. It may be taken on a lump of sugar.

[2. PILULÆ COPAIBÆ, U. S.; *Copaiba Pills*.—(Take of Copaiba ζj ; Magnesia, recently prepared, ζj . Mix them and set aside till it concretes into a pilular mass, which is to be divided into two hundred pills.)—This preparation affords a convenient mode of giving copaiba. Dose, two to six.]

3. GELATINE CAPSULES OF COPAIVA; *Buccæ Copaiiferae fictitiæ*, Pharm. Castrensis Ruthenica.—(Prepared by dipping the bulbous extremity of a metallic rod into a concentrated solution of gelatine. When the rod is withdrawn, it is to be rotated in order to diffuse the gelatine equally over the bulb. As soon as the gelatinous film has hardened, it is to be removed from the bulb and placed on pins furnished with heads, and fixed on a cork table. When dried, the capsules are placed in little cells in the cork table; the balsam is introduced into them by means of a glass tube, and they are then closed by dropping some concentrated solution of gelatine on the orifices.²)—Desfontenelle³ has described another method of making the capsules. Gelatine capsules are the invention of a Frenchman of the name of Mothe; they have been introduced with the view of avoiding the nauseous odour and taste of various medicines (as balsam or oil of copaiva, oil of cubebs, creasote, Dippel's oil, &c.). When swallowed, the gelatinous capsule dissolves in the gastro-intestinal juices, and the liquid medicine escapes. The capsules found in the shops are olive-shaped, and contain about ten grains of balsam. Ratier⁴ has proposed to introduce them into the rectum. For this purpose they are to be conveniently greased.

OTHER MEDICINAL LEGUMINOSÆ.

1. SPARTIUM JUNCEUM, or *Spanish broom*, the *σπαρτίον* of Dioscorides, is occasionally employed in medicine. The seeds, in large doses, are emetic and purgative; in small quantities, diuretic. They have been employed by Dr. Eccles⁵ in dropsical affections. Their advantage over other

¹ *Journ. de Pharm.* xv. 95.

² For farther details, consult Sir James Wylie's *Pharmacopœia Castrensis Ruthenica*, p. 681, Petropoli, 1840.

³ *Journ. de Chim. Méd.* vi. 103, 2d sér.; and *Lancet*, March 7, 1840.

⁴ *Dict. Prat. de Méd.* xv. 288.

⁵ Pearson, *Observ. on Broomseed*, Lond. 1835.

diuretics is their tonic operation, in consequence of which they may be persisted in for an indefinite length of time (Pearson). They may be taken, in the form of *powder*, in doses of from grs. x to grs. xv. three times a day, in cold ginger-tea or mint-water; but the *tincture* (prepared by digesting 3ij of the bruised seeds in f3viij of proof spirit) is the best form of exhibition. Its dose is ʒij to ʒiij.

2. The *BUTEA FRONDOSA* is a middling-sized tree, common in Bengal and in the mountainous parts of India. "From natural fissures and wounds made in the bark of this tree, during the hot season, there issues a most beautiful red juice, which soon hardens into a ruby-coloured, brittle, astringent gum.¹ This is *gum butea*; it has been recently brought over by Mr. Beckett, by whom samples were given to Dr. Royle.² On examination, I found this gum to be identical with a substance which I had previously met with in an old drug firm of this city, marked *gummi rubrum astringens*, and samples of which I had sent to Professor Guibourt, who has described it under the name of *gomme astringente de Gambie*,³ believing it to be the kind described by Fothergill.⁴ But I have already expressed my opinion that it is not Fothergill's gum. *Butea* gum (called *Kuenee* in Northern India, and *Kinsuka* in Sanscrit) is in small elongated tears, which are blackish externally, and have pieces of bark adhering to them. Small fragments, examined by transmitted light, are observed to be ruby-red. Its taste is astringent. It contains from 15 to 25 per cent. of impurities (wood, bark, small pebbles, and sand). According to Mr. E. Solly, the gum, when purified by simple solution of water, so as to separate the impurities, consists of *tannin* 73.26, *difficultly soluble extractive* 5.05, *gum* (with *gallic acid* and *other soluble substances*) 21.67. It is used by the natives of North-western India for precipitating their indigo, and in tanning. English tanners, however, object to its use on account of the colour which it communicates to the leather.⁵

3. *INDIGO* (*pigmentum indicum*; *ινδικον*, Dioscorides; *indicum*, Pliny) is a blue pigment, obtainable from various plants by fermentation. The ancients also applied the term *ινδικον*, or *indicum*, to some other substances.⁶ The indigo of commerce is procured from the genus *Indigofera*. In India, *I. tinctoria* is commonly cultivated for this purpose. During the fermentation, the indigo is deposited as a feculent matter. Lime-water promotes its separation. Blue indigo does not exist in the plants previous to fermentation; it is, therefore, a product, not an educt of them. Commercial indigo is principally brought from the East Indies, but a considerable quantity is imported from Guatemala, and other places. It usually occurs in cubical cakes of an intense blue colour. Rubbed with a smooth hard body (as the nail), it assumes a coppery or bronze hue. It is insoluble in water, cold alcohol, ether, diluted sulphuric or hydrochloric acids, weak alkaline solutions, and cold oils (both fixed and volatile). When heated to about 550° F. it evolves a reddish, violet vapour (vapour of *indigotin*), which condenses in minute crystals. This distinguishes it from Prussian blue. Deoxidizing agents (as protosulphate of iron, sesquisulphuret of arsenic, the process of fermentation, &c.) destroy its blue colour by abstracting oxygen from the indigotin, and converting it into *indigogen*, or *white indigo*; which, by exposure to the air, attracts oxygen, and becomes blue. Chlorine and the hypochlorites destroy the blue colour of indigo. Rubbed with oil of vitriol it yields a deep blue liquid, commonly termed *sulphate of indigo*, *Saxon blue*, or *liquid blue*. Commercial indigo consists of *indigo blue* (indigotin), *indigo brown*, *indigo red*, and a glutinous substance. In-

Fig. 382.

*Spartium junceum.*

Fig. 383.

*Butea frondosa.*

Fig. 384.

*Indigofera tinctoria.*¹ Roxburgh, *Fl. Indica*, iii. 245.² *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 50, Lond. 1838.³ *Hist. des Drog.* 3me édit. ii. 428.⁴ *Med. Obs. and Inq.* 4th edit. i. 353.⁵ *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 144, Lond. 1841.⁶ Beckmann, *Hist. of Inven. and Discov.* iv. 118.

digotin consists, according to Dumas, of $C^{16}H^{15}N^{10}O^2$. Indigo has, of late years, been employed as a medicine. Its physiological effects, according to Dr. Roth,¹ are as follows: shortly after taking it the patient experiences a sense of constriction at the fauces, and the impression of a metallic taste on the tongue. These are followed by nausea, and frequently by actual vomiting. The intensity of these symptoms varies in different cases. In some, the vomiting is so violent as to preclude the farther use of the remedy. The matter vomited presents no peculiarity except in its blue colour. When the vomiting has subsided, diarrhœa usually occurs; the stools are more frequent, liquid, and of a blue or blackish colour. The vomiting and diarrhœa are frequently accompanied by cardialgia and colic. Occasionally these symptoms increase, and the use of the remedy is in consequence obliged to be omitted. Dyspepsia and giddiness sometimes succeed. The urine has a brown, dark, violet colour; but Dr. Roth never found the respiratory matter tinged with it. After the use of indigo for a few weeks, twitchings of the muscles sometimes were observed, as after the use of strychnia. It has been employed principally in spasmodic affections—viz. epilepsy, convulsions of children, chorea, and hysteria. In epilepsy, it has been tried by Von Stahly, Lenhossek, Grossheim, Ideler, Wolf, Leineweber, Dœpp² and Noble,³ with good effect. Some of the successful cases were of very long standing. Roth says, that at the commencement of the treatment the frequency of the paroxysms was invariably increased. Idiopathic epilepsy is said to have been more benefited by it than the symptomatic epilepsy. I have tried it in a considerable number of epileptic cases at the London Hospital, but without deriving the least benefit from it. The dose of indigo should be as large as the stomach can bear. At the beginning it may be a few grains; afterwards this quantity should be increased to drachms, or even an ounce or more in the day. Some of the patients above referred to took from $\frac{3}{4}$ ss to $\frac{3}{4}$ l, daily, for three or more months. The best mode of exhibiting it is in the form of an electuary, composed of one part of indigo and two parts of syrup, with a small portion of water. The powder is apt to cause spasm of the fauces. Aromatics, mild tonics, astringents, and opiates (as the *compound powder of ipecacuanha*), may be conjoined, according to circumstances.

ORDER LXVI. TEREBINTHACEÆ, *Jussieu*.—THE TERE- BINTH TRIBE.

BURSERACEÆ, XANTHOXYLACEÆ, CANNARACEÆ, AMYRIDACEÆ, and ANACARDIACEÆ, *Lindley*.

CHARACTERS.—*Flowers* hermaphrodite, polygamous, or diœcious. *Sepals* 3 to 5, more or less united at the base, imbricated in æstivation, very rarely adherent to the ovary. *Petals* rarely 0, generally distinct, as many as, and alternate with, the sepals, very seldom united at the base; imbricated in æstivation. *Stamens*, as well as the petals, arising from the lower part of the calyx, or from the calycine disk, rarely from the torus surrounding the ovary; either equal in number to, and alternate with, the petals, or double (very rarely quadruple) the number of the petals, and then placed alternately before and between the petals. *Carpels*, in some, numerous, distinct, with one style, in others many, united by the ovaries; in either case some of them are frequently abortive, and hence the carpels in many appear solitary, 1-celled, but the number of the styles and stigmas then usually indicates abortion. *Fruit* capsular or drupaceous. *Seeds* few, usually solitary, commonly exalbuminous. *Embryo* straight, curved, arched, or folded back; *cotyledons* various; *radicle* usually superior. (De Cand.)

PROPERTIES.—The principles common to all the Terebinthaceæ, are: 1st, *Fixed oil* in the seeds; 2dly, *Volatile oil combined with resin* in the turpentine of the pistacias; 3dly, *Resin* which flows either naturally or from artificial openings in the stems of many of the species; 4thly, *Gum usually combined with resin*—as in olibanum, myrrh, tacamahaca, &c.⁴

286. PISTACIA TEREBINTHUS, *Linn. L. E. D.*—THE TURPEN- TINE PISTACIA.

Sez. Syst. Diœcia, Pentandria.

(Oleo-resina, *L.*—Liquid resinous exudation, *E.*)

HISTORY.—This tree is the *Τέρευνθος* or *Τερίβυνθος* of the Greeks. Hippocrates employed the fruits, the buds, and the resin, medicinally.

BOTANY. *Gen. Char.*—*Flowers* diœcious, apetalous. *Males*: *Racemes* ament-

¹ *Dis. Inaug. de Indigo*, Berol. 1834; and *Brit. and For. Med. Rev.* ii. 244.

² *Roth, op. cit.*; *Dierbach. Neuest. Entd. in d. Mat. Med.* i. 222, 1837.

³ *Fée, Cours d'Hist. Nat.* i. 619. ⁴ *Lond. Med. Gaz.* xvii. 1038.

aceous, with 1-flowered scales [bracts]. *Calyx* 5-cleft. *Stamens* 5; *anthers* almost sessile, 4-cornered. *Females*: *Racemes* more lax. *Calyx* 3- or 4-cleft. *Ovary* 1- to 3-celled. *Stigmas* 3, rather thick. *Drupe* dry, ovate, with a somewhat osseous nut, usually 1-celled, 1-seeded, sometimes bearing two abortive cells at the side. *Seeds* solitary in the cells, affixed to the side of the cell, exalbuminous. *Cotyledons* thick, fleshy, oily, with a superior lateral radicle.—*Trees* with pinnate leaves. (De Cand.)

Sp. Char.—*Leaves* pinnate, with an odd one; *leaflets* about 7, ovate-lanceolate, rounded at the base, acute, mucronate. (De Cand.)

A tree of 30 or 35 feet in height. Young leaves reddish, old ones dark-green. *Racemes* compound. *Fruit* almost round, purplish.

Hab.—Syria and the Greek Archipelago.

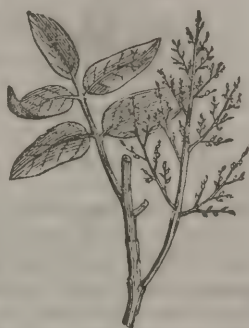
EXTRACTION.—Tournefort¹ says, that the turpentine harvest in Scio is made, from the end of July to October, by cutting crosswise with a hatchet the trunks of the largest turpentine trees. The turpentine runs down on flat stones placed under the trees, where it hardens. The quantity yielded by each tree is small, not exceeding eight or ten ounces.

PROPERTIES.—Chian or Cyprus turpentine (*Terebinthina Chia seu Cypria*) has the general properties of the coniferous turpentines already described. Its consistency is that of honey, but more glutinous. Its colour is greenish-yellow. It has an agreeable turpentine-like odour, combined with the odour of fennel, or, according to some, of citron and jasmine. Its taste is very mild. By keeping, it resinifies, and acquires a somewhat less agreeable odour. Genuine Chian turpentine is scarce; the coniferous turpentines being usually sold for it.

COMPOSITION.—I am unacquainted with any analysis of it; but its composition is doubtless similar to the coniferous turpentines.

PHYSIOLOGICAL EFFECTS, USES, AND ADMINISTRATION.—Exactly similar to the other coniferous turpentines.

Fig. 385.



Pistacia Terebinthus (the female plant).

287. PISTACIA LENTISCUS, Linn. L. E. D.—THE MASTIC OR LENTISK TREE.

Sex. Syst. Diccia, Pentandria.

(Resina ex inciso cortice fusa, L.—Concrete resinous exudation, E. D.)

HISTORY.—This tree is the Σχίνος of the Greeks. Hippocrates employed the leaves, resin (*mastic*), and the oil prepared from the fruit, in medicine.

BOTANY. Gen. Char.—See *Pistacia Terebinthus*.

Sp. Char.—*Leaves* abruptly pinnate; *leaflets* about 8, lanceolate. *Petiole* winged. (De Cand.)

A mere bush. *Leaves* evergreen. *Flowers* very small. In var. β *angustifolia* the leaflets are somewhat linear; in var. γ *Ohia* they are ovate.

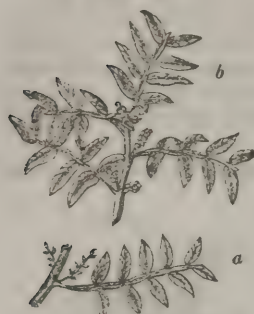
Hab.—South of Europe, North of Africa, Levant.

EXTRACTION.—Tournefort² says, that in Scio the extraction of mastic commences on the first of August. The bark is cut crosswise with huge knives. The mastic exudes and hardens partly on the stem, partly on the ground. The same incisions furnish mastic towards the end of September, but in lesser quantities. The mastic which concretes on the stem is called *mastic in the tear*, while that which falls to the earth constitutes *common mastic*.

¹ *Voyage into the Levant*, ii. 62, Lond. 1741.

² *Ibid.* 60

Fig. 386.

*Pistacia Lentiscus.*

a. The male plant.

b. The female plant.

PROPERTIES.—Mastic (*mastiche*) occurs in small spherical, flattened, or irregular, pale-yellow tears, which are externally farinaceous, owing to their mutual attrition. Their fracture is vitreous. They have a mild, agreeable odour, and an aromatic taste.

COMPOSITION.—Mastic consists of a minute portion of volatile oil, about 90 per cent. of resin soluble in alcohol, and 10 per cent. of a resinous substance (*masticine*) insoluble in alcohol.

1. **SOLUBLE ACID MASTIC RESIN; Resin α ; Masticic Acid.**—This resin is soluble in alcohol. It possesses the properties of an acid, and combines with bases to form four series of salts. Its formula, according to Johnstone, is $C^{40}H^{31}O^4$.

2. **INSOLUBLE NON-ACID MASTIC RESIN; Resin β ; Masticine.**—This resin is insoluble in alcohol. It is white, elastic, tenacious, soluble in an alcoholic solution of resin α , as well as in ether and oil of turpentine. Its formula, according to Johnstone, is $C^{40}H^{31}O^2$. To this resin mastic owes its toughness.

PHYSIOLOGICAL EFFECTS.—Analogous to common

resin and the turpentine.

USES.—Mastic is rarely employed as a medicine. It has been used to check excessive discharges from the mucous membranes, as leucorrhœa, gleet, chronic pulmonary catarrh, and old diarrhœas. Dentists occasionally employ it for filling up the cavities of carious teeth. The Turkish ladies chew it to sweeten the breath, and preserve the teeth and gums. Dissolved in alcohol, it forms a very useful cement and varnish. A solution of it in oil of turpentine is a common varnish.

ADMINISTRATION.—It is exhibited as an adjunct only to other medicines. It is a constituent of the *dinner pills* (composed of aloes ʒvj; mastic and red roses, āā ʒij; syrup of wormwood q. s.), in which it serves to divide the particles of the aloes. It is a constituent of the *tinctura ammoniæ composita*, Ph. L.; formerly called *eau de luce*, or *spiritus ammoniæ succinatus*, which has been already described.

288. RHUS TOXICODENDRON, Linn.—TRAILING POISON OAK, OR SUMACH.

Sex. Syst. Pentandria, Trigynia.

HISTORY.—The attention of medical practitioners of this country was first drawn to the medicinal properties of this plant in 1793, by Dr. Alderson, of Hull.¹ It was first described by Cornutus, in his *Plant. Canad. Hist.* Paris, 1635.²

BOTANY. Gen. Char.—*Calyx* small, 5-partite, persistent. *Petals* 5, ovate, spreading. *Stamens* 5, all fertile in the male and hermaphrodite flowers. *Ovary* 1, somewhat globose, 1-celled. *Styles* short, 3, or *stigmas* 3 sessile. *Drupe* almost juiceless, 1-celled; nut bony, perhaps by abortion 1-seeded, and sometimes 2- or 3-seeded. *Seed* exalbuminous, invested by the funiculus arising from the base of the nut; *cotyledons* foliaceous; *radicle* incumbent on the upper edge of the cotyledons. (De Cand.)

Sp. Char.—*Leaves* pinnate with an odd leaflet, trifoliate; *leaflets* angularly incised, pubescent. (De Cand.)

Shrub, 1 to 3 feet high. *Stems* many, branching, covered with a brown bark. *Flowers* greenish-white. *Fruit* a round drupe, about as large as a pea.—*Juice* acid, milky, becoming black by exposure to the air, and forming an indelible ink when applied to cotton or linen.

Rhus Toxicodendron is considered by some botanists as a variety only of *Rhus radicans*. I have followed Nuttall and De Candolle in considering it a distinct species.

¹ *Essay on Rhus Toxicodendron*, 3d edit. 1804.

² Busse, *Diss. Inaug. de Rhoe Toxicod.* p. 10, Berol. 1811.

Hab.—United States of America.

COMPOSITION.—I am not acquainted with any detailed analysis of this plant. There are at least two substances in it worthy of investigation, viz: *a volatile, acrid (narcotico-acrid?) principle*, and *the substance which blackens by exposure to the air*. Tannic and gallic acids are said to be constituents of it.

PHYSIOLOGICAL EFFECTS. **1. Of the Emanations.**—When not exposed to the sun's rays, as when it grows in shady places, and during the night, this plant evolves a hydrocarburetted gas, mixed with an acrid vapour, which acts most powerfully on certain individuals exposed to its influence, and produces violent itching, redness, and erysipelatous swelling of the face, hands, or other parts which have been subjected to its operation; these effects are followed by vesications, and desquamation of the cuticle. In some cases, the swelling of the face has been so great as to have almost obliterated the features; but all persons are not equally susceptible of this poisonous operation; so that some peculiar condition of the cutaneous organ seems necessary for the effect to be produced.¹

2. Of the Plant. *a. On Animals.*—Orfila made several experiments with the watery extract of the *Rhus radicans* (whose operation is probably quite similar to that of *R. Toxicodendron*), and concludes that “internally administered, or applied to the cellular texture, it produces a local irritation, followed by an inflammation more or less intense, and that it exerts a stupefying action on the nervous system after being absorbed.” Lavina gave a few drops of the milky juice of *Rhus Toxicodendron* to guinea-pigs and birds, which were at first stupefied by it, but gradually recovered without any other noxious effect.

β. On Man.—In the human subject, *small doses* of the leaves increase the secretions of the skin and kidneys, act slightly on the bowels, and, in paralyzed persons, are said to have produced a return of sensibility and of mobility, with a feeling of burning and pricking, with twitchings, in the paralyzed parts. *Large doses* occasion pain in the stomach, nausea, vomiting, giddiness, stupefaction, and an inflammatory swelling of the paralyzed parts. These effects show that the poison oak possesses the twofold operation of an acrid and a narcotic.

USES.—It has been employed in old paralytic cases depending on a torpid condition of the nerves. It has also been given in chronic rheumatism, obstinate eruptive disorders, in some cases of amaurosis, and other nervous affections of the eyes.

ADMINISTRATION.—The *powder* of the leaves is given in doses of from half a grain to a grain, gradually increased until some obvious effect is produced.

[It has been excluded from the *Materia Medica* in the last editions of the London and Dublin Pharmacopœias.—ED.]

239. BOSWELLIA THURIFERA, Colebrooke.—THE OLIBANUM TREE.

Boswellia serrata of former Pharmacopœias.

Sex. Syst. Decandria, Monogynia.

HISTORY.—Olibanum was the frankincense used by the ancients in their religious ceremonies. It is the *Lebonah* of the Hebrews, the *Lubán* of the Arabs; from either of which terms the Greeks, probably, derived their names for it, Λιβανός, Λιβανωτός.² The earliest notice of it is by Moses.³ Dioscorides⁴ calls it Λιβανός.

BOTANY. **Gen. Char.**—*Flowers* bisexual. *Calyx* small, 5-toothed, persistent. *Petals* 5, obovate-oblong, very patent, acute at the base, inserted under the margin of the disk; æstivation very slightly imbricative. *Stamens* 10, inserted under the disk, alternately shorter; *filaments* subulate, persistent; *anthers* caducous. *Torus* a cup-shaped disk, fleshy, larger than the calyx, crenulated on the margin. *Ovary*

¹ Orfila, *Toxicol. Gén.*

² *Exodus*, xxx. 34.

³ Colebrooke, *Asiat. Research.* ix. 377.

⁴ *Lib. i. cap. 81.*

oblong, sessile; *style* 1, the length of the stamens, caducous; *stigma* capitate, 3-lobed. *Fruit* capsular, 3-angled, 3-celled, 3-valved, septiceidal; valves hard. *Seeds* solitary in each cell, surrounded by a broad membranaceous wing. *Cotyledons* intricately folded, multifold.—*Trees* producing balsam and resin. *Leaves* deciduous, alternate towards the top of the branches, unequally pinnated; *leaflets* opposite, serrated. *Stipules* 0. *Racemes* terminal or axillary. *Flowers* on short pedicels, white (Wight and Arnott).

Sp. Char.—*Leaflets* oblong, obtuse, serrated, pubescent. *Racemes* axillary, single, shorter than the leaves (Wight and Arnott).

Hab.—Mountainous parts of Coromandel.

DESCRIPTION.—*Olibanum*, *Indian Olibanum*, or *Olibanum of the Boswellia serrata* (*gummi-resina Olibanum*; *gummi Olibanum*; *Olibanum indicum* seu *ost-indicum*), is imported from India in chests. It consists of round, oblong, or ovate pale-yellowish, semi-opake, fragile tears, having a balsamic resinous odour.

Mr. Johnstone states that it is a mixture of at least two gum-resins:—

1. *One variety* of gum-resin consists of opake, dull, hard, and brittle pieces, which, when introduced into alcohol, become almost immediately white and opake, from a white powdery coating or crust left on their surface as the soluble portion is taken up. This variety constitutes the larger portion of the olibanum of commerce, and is the more fragrant when burned. It contains an acid resin and a volatile oil.

2. The *second variety* is in clearer, yellower, less brittle and opake pieces, generally in long tears (stalactitic?), as they have flowed from the tree. When introduced into alcohol, they become clear and transparent. They contain less gum. Their resin resembles colophony.

On the above statement I may remark, that all the tears of olibanum which I have tried became opake when immersed in alcohol.

The substance called on the continent AFRICAN or ARABIAN OLIBANUM (*Olibanum arabicum*) is rarely met with in this country. It consists of smaller tears than those of the Indian variety. They are yellowish or reddish, and intermixed with crystals of carbonate of lime. Some have supposed it to be the produce of *Juniperus*—some of an *Amryis*—others of *Boswellia glabra*, which Roxburgh says yields a substance used as an incense and a pitch in India.

COMPOSITION.—Olibanum (Indian?) was analyzed by Braconnot,¹ who found the constituents to be as follows: *volatile oil* 8, *resin* 56, *gum* 30, *matter like gum*, *insoluble in water and alcohol*, 5.2; *loss* 0.8.

1. **VOLATILE OIL.**—By distillation with water, olibanum yielded Stenhouse,² colourless volatile oil, similar to oil of turpentine, but smelling more agreeably. Its formula is $C^{35}H^{28}O$, which is identical with that for oil of spearmint.

2. **RESIN.**—According to Johnston,³ olibanum contains two kinds of resin.

a. Acid Resin.—This is found in the rounded, opake, dull, hard, and more brittle pieces, which become covered with a white crust. Its formula is $C^{40}H^{32}O^6$.

β. Resin resembling Colophony.—This is found in the clearer, yellower, less brittle and opake long tears (stalactitic?). Its formula is $C^{40}H^{22}O^4$.

PHYSIOLOGICAL EFFECTS.—Olibanum is regarded as a stimulant of the same kind as the resins or oleo-resins.

USES.—It is rarely employed internally. Formerly it was used to restrain excessive discharges from the mucous membranes. Thus it was given in chronic diarrhoea, old catarrhs, but more especially in leucorrhœa and gleet. It was also administered in affections of the chest; as hæmoptysis. It has been used as an ingredient of stimulating plasters. As a fumigating agent it is employed to overpower unpleasant odours, and to destroy noxious vapours.

ADMINISTRATION.—Dose, ʒss to ʒj, formed into an emulsion by the aid of the yolk of an egg.

¹ *Ann. de Chim.* lxxiii. 60.

² *Phil. Trans.* for 1839, p. 304–5.

³ *Pharm. Central-Blatt für 1840*, p. 628.

290. BALSAMODENDRON MYRRHA, Nees, L. E. D.—THE MYRRH TREE.

Sex. Syst. Octandria, Monogynia.

(Gummi-resina e cortice exudata, L.—Gummy-resinous exudation, E. D.)

[Myrrha, U. S.]

HISTORY.—The earliest notice of myrrh occurs in the Old Testament,¹ from which it appears that this gum-resin was an object of trade with the Eastern nations more than 3,500 years ago. In the Hebrew language it is termed *Mur*, in allusion to its bitterness. The Greeks, who were well acquainted with it, called it *Σύμυρα*; or, in the Æolic dialect, *Μύρρα*. Hippocrates² employed it in medicine in several diseases; and Dioscorides³ describes several kinds of it, the most esteemed being the *Troglodytica*. Some of the ancient poets tell us that the name of this gum-resin was derived from Myrrha, the daughter of Cinyras, King of Cyprus, who fell in love with her own father, and after having had criminal intercourse with him, fled to Arabia, where she was changed into a tree which still bears her name.

Notwithstanding the early knowledge of, and acquaintance with, the uses of myrrh, we had no accurate account of the tree which yields it until the return of Ehrenberg from his travels with Hemprich, during 1820—25, in various parts of Africa and Asia. He brought with him a specimen of the tree, which has been described and figured by Nees von Esenbeck⁴ under the name of *Balsamodendron Myrrha*. The first notice of the discovery of these travellers which I have met with, is in Alex. Humboldt's "*Bericht über die naturhistorischen Reisen der Herren Ehrenberg und Hemprich*," &c. published at Berlin in 1826.

BOTANY. **Gen. Char.**—*Flowers* irregular. *Calyx* 4-toothed, persistent. *Petals* 4, linear-oblong; æstivation induplicate-valvate. *Stamens* 8, inserted under the annular disk; elevated warts between the stamens. *Ovary* 1. *Style* 1, short, obtuse. *Berry* or *drupe* ovate, acute, with four sutures, 1- to 2-celled; cells 1-seeded.—*Oriental trees* giving out balsam. *Leaves* pinnated; leaflets 3 to 5, sessile, without dots. (De Cand.)

Sp. Char.—*Stem* shrubby, arborescent; branches squarrose, spinescent. *Leaves* ternate; *leaflets* obovate, obtuse, obtusely tooth-letted at the apex, the lateral smooth. *Fruit* acuminate. (Nees.)

Bark pale, ash-gray, approaching white. *Wood* yellowish-white; both it and the bark have a peculiar odour. *Leaves* on short stalks. *Flowers* unknown. *Fruit* ovate, smooth, brown, somewhat larger than a pea; surrounded at the base by a four-toothed calyx, and supported on a very short stalk.

Hab.—Gison, on the borders of Arabia Felix.

This species is considered by Lindley⁵ to be identical with the *Amyris Kataf* of Forskål,⁶ the *Balsamodendron Kataf*, Nees; *Protium Kataf*, Lindley. But the identity of the two plants is by no means satisfactorily demonstrated. *A. Kataf*, is distinguished, 1st, by the absence of thorns; 2dly, by the leaves being four times larger, and the lateral leaflets agreeing both in form and size with the terminal ones; 3dly, the fruit (according to Forskål) is round, with a depressed umbilicus at the point.

EXUDATION OF MYRRH.—Myrrh, according to Ehrenberg, exudes, like cherry-tree gum, from the bark of the tree. It is at first soft, oily, and of a pale yellow-colour; but, by drying, becomes darker and redder.

DESCRIPTION.—Myrrh (*gummi-resina myrrha*; *gummi-myrrha*) is imported from the East Indies in chests, each containing from 1 to 2

Fig. 387.



Balsamodendron Myrrha.

a. A leaf. b. The fruit.

¹ Gen xxxvii. 25.

² Lib. i. cap. 77.

³ Fl. Med. 170.

⁴ See Dierbach, *Arzneim. des Hippok.* p. 224.

⁵ *Beschr. Offic. Pflanz.*

⁶ *Fl. Egypt. Arab.* 80.

hundred weight. Formerly the finest kind was brought from Turkey (*Turkey myrrh*), and an inferior one from the East Indies (*East India myrrh*); but at the present time nearly the whole is brought from India. In 1839, duty (6s. per cwt.) was paid on 216 cwt. Sometimes the same chest contains myrrh of all qualities, which is then termed *myrrh in sorts* (*myrrha naturalis seu myrrha in sortis*); but commonly it is brought over more or less sorted.

Myrrh is only partially soluble in water, alcohol, or ether; the first of those liquids takes up the gum principally, the two latter the resin and oil. Water takes up more of the myrrh than alcohol does. Alkaline solutions are good solvents for myrrh. A few drops of nitric acid dropped on a small fragment of myrrh, or on a concentrated tincture, develop a red colour.

1. **Myrrh of first quality**; *Turkey myrrh* (*Myrrha turcica*; *M. vera seu rubra vel pinguis*).—It occurs in pieces of irregular forms, and of variable sizes, consisting of tears (either distinct or agglomerated), usually covered with a fine powder or dust. In a chest of this kind a few pieces of fine quality may sometimes be met with, nearly as large as a man's fist. The colour varies, being pale reddish-yellow, red, or reddish-brown. The pieces are fragile, semi-transparent, with a dull, in part splintery, fatty kind of fracture. In consequence of imperfect desiccation, the largest and finest pieces often present internally, opaque, whitish or yellow striæ, or veins which have been compared by Dioscorides, Pliny, and many others, to the white marks on the nails. The odour of myrrh is aromatic and balsamic, peculiar, but to most persons pleasant; the taste is bitter, acrid, and aromatic. The purest, palest, and most odorous pieces are sold as *picked myrrh* (*myrrha electa seu selecta*).

2. **Myrrh of second quality**; *Myrrh in distinct small tears or grains*.—Imported from the East Indies in chests. It consists of distinct tears or grains, which are rounded or irregular, and vary in size from that of a pin's head to a pepper-corn, none of them in my specimens being so large as a small pea. They are somewhat shiny, more or less transparent, and vary in colour from pale or whitish-yellow to reddish-brown. It consists of tears of myrrh intermixed with fragments of gum-Arabic, and of some resin very like mastic, or juniper. Many druggists in this country regard it as merely the siftings of the finest kind; but I cannot agree with them in this opinion.

3. **Myrrh of third quality**; *East India Myrrh* (*Myrrha indica seu ostindica*).—Formerly this was the only kind imported from the East Indies. It occurs in pieces, which are darker coloured than those of the so-called Turkey myrrh, and whose average size does not exceed that of a walnut. It is often mixed with other substances, particularly with *Indian Bdellium* (the produce of *Amyris Commiphora*), and with a substance of similar appearance to dark red-coloured Senegal gum (*Opocarpus*?).

COMPOSITION.—Myrrh was analyzed, in 1816, by Pelletier,¹ and in 1819 by Braconnot² and by Brandes.³

	Brandes.	Braconnot.	Pelletier.
Volatile oil	2.60	2.5	
Resin { soft	22.24	23.0	34
{ hard	5.56		
Gum { soluble (Arabine?)	54.38	46.0	66
{ insoluble	9.32	12.0	
Salts (benzoates, malates, phosphates, sulphates, } and acetates of potash and lime) }	1.36		
Impurities	1.60		
Loss	2.94	16.5	
	100.00	100.0	100

1. **VOLATILE OIL**.—Colourless, though by age it becomes yellowish. It is a thin fluid, heavier than water, having the odour and taste of myrrh, and being soluble in alcohol, ether, and the fixed oils. It partially evaporates in the air, the residue being a glutinous varnish-like

¹ *Ann. de Chim.* lxxx. 45.

² *Berl. Jahrb.* xxii. 275.

³ *Ibid.* lxxvii. 52.

substance. It readily distils over with water, but not with spirit. With sulphuric, nitric, and hydrochloric acids, it forms red solutions.

2. **RESIN.**—According to Brandes, this is of two kinds, both of which are soluble in alcohol.

a. Soft resin.—Odorous, soft at ordinary temperatures, and insoluble in ether. Unverdorben regards it as a mixture of hard resin and volatile oil.

β. Hard resin (Myrrhic acid?).—Inodorous, hard, insoluble in ether, soluble in caustic alkalies, forming resinsates (*myrrhates*?). The resinate of baryta is soluble in water, but not in alcohol.

3. **GUM.**—Is also of two kinds; *a. Soluble* in water; the solution forming precipitates with alcohol and the salts of lead, silver, the protosalts of tin, and of mercury. *β. Insoluble* in water.

PHYSIOLOGICAL EFFECTS.—In *small* or *moderate* doses, myrrh promotes the appetite, creates an agreeable warmth in the stomach, and occasions slight constipation. Its continued employment in these quantities assists the assimilative functions, increases the muscular activity, gives greater firmness to the solids, and diminishes excessive secretion from the mucous membranes.

In *large* doses (as from half a drachm to a drachm) it excites a disagreeable sensation of heat in the stomach, and in irritable conditions of this viscus may even bring on a slight inflammatory state; it accelerates the frequency and increases the fulness of the pulse, gives rise to a febrile condition of the body, and creates a feeling of warmth in the mucous membrane (especially in the membrane lining the air-passages). It has been supposed to have a specific stimulant operation on the uterus, and has, in consequence, been termed emmenagogue; but it does not appear to have any title to this appellation.

The local operation of myrrh is that of a mild astringent and a moderate stimulant. Kraus¹ says it is very similar to that of cinchona. In its remote effects, myrrh partakes of both the tonic and stimulant characters, and hence some have denominated it a *tonico-stimulant*; and as its stimulant powers are analogous to those of the balsams, it has also been called a *tonico-balsamic*.

Myrrh differs from the fetid gum-resins (assafoetida, galbanum, &c.) in not possessing that influence over the nervous system which has led to the use of the latter in various spasmodic diseases, and to their denomination of antispasmodics. From the balsamic substances it is distinguished by its tonic influence. It has some relation to cascarrilla, but is more stimulant.

USES.—The employment of myrrh is indicated in diseases characterized by feebleness of the vascular action, by weakness of the muscular fibre, and by excessive secretion from the mucous membrane. Relaxed and leucophlegmatic constitutions best admit of its use. It is frequently associated with tonics, especially the chalybeates, or with aloes. Indeed, it is rarely used alone. It is contraindicated in inflammatory diseases, and in plethoric individuals. It is used in the following cases:—

1. In *disordered conditions of the digestive organs* arising from or connected with an atonic condition of the alimentary canal, as in some forms of dyspepsia, apepsia, flatulence, &c.

2. In *disordered states of the menstrual functions* characterized by a lax and debilitated state of the system, as in many cases of amenorrhœa and chlorosis.

3. In *excessive secretion from the mucous membranes* unconnected with inflammatory symptoms, and accompanied by marks of debility. In chronic pulmonary catarrh, for example, it is sometimes admissible and useful. It has also been used to check puriform expectoration in phthisis pulmonalis, though it is now rarely employed for this purpose, as in most cases it proves either useless or injurious. In mucous discharges from the urino-genital organs, as well as from the alimentary canal, it has also been administered.

4. As an *external application*, myrrh is employed for various purposes. Thus it is used as a *dentifrice*, either alone or mixed with other substances; and in caries of the teeth, and in a spongy or ulcerated condition of the gums, is very serviceable. As a *gargle* in ulcerations of the throat, tincture of myrrh, diluted with water, is

frequently employed. In *foul ulcers*, myrrh has been used to destroy unpleasant odour, to promote granulations, and to improve the quality and diminish the quantity of the secreted matters; for these purposes, it has been applied in a pulverulent form, as an ointment, or as a wash.

ADMINISTRATION.—Dose, gr. x to ʒss. It is given in the form of powder, pill, or emulsion. The aqueous infusion and extract, which have been recommended for their mildness, are seldom employed, and very rightly so, as I conceive. Myrrh is a constituent of several pharmacopœial preparations; as *Mistura ferri composita*, *Pilulæ ferri compositæ*, *Pilulæ aloës cum myrrhâ*, *Decoctum aloës compositum*, *Pilulæ rhei compositæ*, and *Pilulæ galbani compositæ* (see these preparations).

TINCTURA MYRRHÆ, L. E. D. [U. S.].—(Myrrh, powdered, ʒiij; Rectified Spirit Oij. Macerate for seven days, then press out and strain, L.—The *Edinburgh College* orders three ounces and a half of Myrrh, in moderately fine powder, to the same quantity of Spirit. “Pack the myrrh very gently, without any spirit, in a percolator; then pour on the spirit; and when thirty-three fluidounces have passed through, agitate well, to dissolve the oleo-resinous matter which first passes, and which lies at the bottom. This tincture is much less conveniently obtained by the process of digestion for seven days,” E.)—The *Dublin College* directs four ounces of Myrrh in coarse powder to two pints of Spirit. The maceration to continue for fourteen days, and the liquid to be then strained. [The *U. S. Pharm.* directs four ounces of Myrrh to three pints of Alcohol.]—Tonic and stimulant. Seldom employed internally, and then usually as an adjunct. Dose, ʒss to ʒj. It is applied as a stimulant to foul and indolent ulcers. Diluted with water (which renders it slightly milky by the separation of the resin, without any precipitate being formed), it is used as a wash for the mouth in ulceration and sponginess of the gums, and as a gargle in affections of the throat.

OTHER MEDICINAL TEREBINTHACEÆ.

1. **ELEMI.**—The history and origin of *Elemi* are involved in great obscurity. It appears that the resinous products of various terebinthaceous trees have been described under this name. The *Edinburgh College*, correctly, as I conceive, declare elemi to be the “concrete resinous exudation from one or more unascertained plants.” The *London* and *Dublin Colleges* formerly called it the resin of *Amyris elemifera* of Linnaeus.¹ But this distinguished botanist has confounded, under one name, two distinct plants; viz. *Icica Icicariba*, De Candolle (*Icicariba*, Pison), a Brazilian tree (yielding, according to Pison, a resin similar to the so-called *gum elemi*), and *Amyris Plumieri*, De Candolle, a native of the Antilles, which also yields a resin. The *London College*, in their new Pharmacopœia, no longer speak of elemi as the product of an *Amyris*, but describe it as a concrete turpentine derived from an unknown plant. To assist in determining the origin of elemi, I have taken much pains to ascertain its commercial route; and I find that all the importations of it, which I can trace, were from Amsterdam or Hamburgh. Poinet also states, that true elemi was brought from Holland; whence I conclude that it is the produce of a Dutch settlement. But one of the importers expressed to me his belief (in which I do not coincide), that the elemi brought from Holland was spurious, being made of common frankincense (p. 290). It would appear that formerly it came from Ethiopia by way of the Levant. It is possible that it may be the produce of the *Canarium Zephyrinum sine sylvestre primum Canari Barat* of Rumphius,² which he says yields a resin so like elemi that it may be taken for it, and he puts a query, whether this tree may not be the source of it. I have received from Dr. Christison a specimen of the resin of *Canarium balsamiferum* of Ceylon, which in odour and general appearance strongly resembles elemi. I have met with three kinds of elemi: 1st. *Elemi in flag leaves*; *Résine elemi en pains*, Guibourt; *Resina Elemi orientalis*, Martius. This is imported from Holland in triangular masses, weighing from one to two pounds each, enveloped in a palm-leaf. It agrees in most of its properties with the next variety. Martius ascribes it to *Amyris zeylanica* (*Balsamodendron zeylanicum*, Kunth). But if this were correct, it would doubtless be imported direct from Ceylon to England, which it is not. 2d. *Elemi in the lump*. This differs from the following kind only in its much paler yellow colour. 3d. *Brazilian Elemi*; *Résine élémi du Brésil*, Guibourt. This variety I received from Prof. Guibourt. If it be really brought from the Brazils, it is doubtless obtained from *Icica Icicariba*

¹ See his *Mat. Med.*

² *Herb. Amb.* lib. iii. cap. ii. p. 153.

(De Candolle) by incisions into the stem, and is gathered twenty-four hours afterwards. "It is imported in cases containing two or three hundred pounds each. It is soft and unctuous, but becomes hard and brittle by cold and age. It is semi-transparent, of a yellowish white, mixed with greenish points; its odour is strong, agreeable, analogous to that of fennel, and owing to a volatile oil, which may be obtained from it by distillation. As it owes its properties to this oil, it should be selected recent, not too dry, and strongly odorous" (Guibourt). It is soluble in alcohol, with the exception of its impurities, and a white, opaque, insipid, inodorous, crystallizable substance, called *elemine*, which is soluble in boiling alcohol. Martius describes *African Elemi* (the genuine elemi of the ancients) as being in small pieces like scammony, and having an acrid taste. Bonastre analyzed elemi, and found its constituents to be, *volatile oil* 12.5, *resin soluble in both hot and cold alcohol* 60.0, *resin soluble in hot but not in cold alcohol (elemine)* 24.0, *bitter extractive* 2.0, *impurities* 1.5. The resin α (readily soluble in cold alcohol) consists, according to Johnston, of $C^{40}H^{32}O^4$; while the resin β (sparingly soluble in cold alcohol) is composed of $C^{40}H^{30}O$.

The physiological effects of elemi are similar to those of the terebinthines. It is, however, never employed internally. Its principal or sole use is as a constituent of the *Unguentum Elemi*, L. D., which is composed, according to the *London College*, of Elemi \mathfrak{Z} ij; Common Turpentine \mathfrak{Z} iss; Suet \mathfrak{Z} vj; Olive Oil \mathfrak{Z} ss. The Elemi and Suet are melted together and then removed from the fire, and the turpentine and oil immediately added; the mixture is then expressed through linen. The *Dublin College* employs \mathfrak{Z} iv of Elemi; and \mathfrak{Lj} of White Wax Ointment.—Elemi ointment is stimulative and digestive. It is applied as a stimulant to old and indolent ulcers, and to promote the discharge from issues and setons. It is an imitation of the ointment recommended by Arcæus, in 1574.¹

2. **BALM OF GILEAD** (*Balsamum gileadense*; *B. de Mecca*; *Opobalsamum*; *Balm* of the Old Testament; $\beta\alpha\lambda\sigma\alpha\mu\omega\nu$ of Theophrastus and Dioscorides) is procured from *Balsamodendron gileadense*, a middling-sized tree growing in Arabia. Mr. Bruce says it is obtained by cutting the bark of the tree with an axe, and receiving the juice in a small earthen bottle. The quantity obtained in this way is, however, very small; and none of it, it is said, reaches this country, that which occasionally comes here being obtained by boiling the branches and leaves in water. It is a whitish, turbid, thick, very odorous liquid, which resinifies, and becomes yellow by keeping. Trommsdorff² analyzed it, and found it to consist of *volatile oil* 30.0, *soft resin insoluble in alcohol* 4.0, *hard resin soluble in alcohol* 64.0, *extractive* 0.4, *loss* 1.6. Bonastre³ also analyzed it. Its physiological effects are believed to be similar to balsam of copaiva and the liquid turpentine. The most wonderful properties were formerly ascribed to it. It is rarely or never employed by Europeans, but is adapted to the same cases as the terebinthines. The Asiatics use it for its odoriferous as well as its medicinal qualities.

3. The term **BDELLIUM** is applied to two gummy-resinous substances. One of these is *Indian Bdellium* or *false myrrh* (the *Bdellium* of Scripture), which is obtained from *Amirys* (*Balsamodendron*?) *Commiphora*. Dr. Roxburgh⁴ says that the trunk of this tree is covered with a light-coloured pellicle, as in the common birch, which peels off from time to time, exposing to view a smooth green coat, which in succession supplies other similar exfoliations. This tree diffuses a grateful fragrance, like that of the finest myrrh, to a considerable distance around. Dr. Royle⁵ was informed that this species yielded bdellium; and in confirmation of his statement I may add, that many of the pieces of this bdellium in my museum have a yellow pellicle adhering to them precisely like that procured from the common birch, and some of the pieces are perforated by spiny branches—another character serving to recognize the origin of this bdellium. Indian bdellium has considerable resemblance to myrrh. Many of the pieces have hairs (of the goat?) adhering to them. The other kind of bdellium is called *African Bdellium*, and is obtained from *Heudelotia africana*.⁶ It is a native of Senegal, and is called by the natives, who make toothpicks of its spines, *Niottout*. It consists of rounded or oval tears, from one to two inches in diameter, of a dull and waxy fracture. By age they become opaque, and covered externally by a white or yellowish dust. It has a feeble but peculiar odour, and a bitter taste. Pelletier⁷ found it to consist of *resin* 59.0, *soluble gum* 9.2, *bassorin* 30.6, *volatile oil and loss* 1.2. Resin of bdellium [*African bdellium*?] consists, according to Johnston, of $C^{40}H^{31}O^5$.

Fig. 388.

*Balsamodendron gileadense*.¹ *De recta curand. vulner. ratione*, Amst. 1658.² *Journ. de Pharm.* xviii. 95.³ *Illustr.* 176.⁴ *Ann. de Chim.* lxxx. 39.⁵ Thomson, *Org. Chem.* 523.⁶ *Fl. Ind.* ii. 245.⁷ Richard and Guillemin, *Fl. de Sénégambie*.

ORDER LXVII. RHAMNACEÆ, *Lindley*.—THE BUCKTHORN TRIBE.RHAMNI, *Jussieu*.—RHAMNEÆ, *De Candolle*.

CHARACTERS.—Tube of the *calyx* adherent to the ovary, lobes valvate in æstivation, definite in number, 4 or 5. *Petals* as many as (rarely none), and alternate with the lobes of the calyx; often squamiform with a concave limb. *Stamens* as many as the petals, and opposite to them; *anthers* 2-celled. *Ovary* either adnate to the whole of the calyx, or adherent at the lower part or middle, 2 or 4-celled; cells with 1 ovule each. *Style* 1; *stigmas* 2 to 4. *Pericarp* usually indehiscent, baccate, drupaceous, or samaroidous, rarely capsular. *Seeds* erect, destitute of aril; *albumen* none, or usually fleshy; *embryo* straight in the axis of the seed, with an inferior *radicle*, and somewhat foliaceous *cotyledons*.—*Shrubs* or *trees*. *Leaves* simple, alternate, rarely opposite, often with stipules. *Flowers* small, often greenish. (*De Cand.*)

PROPERTIES.—Require farther examination. The fruit of *Rhamnus* contains purgative and colouring matters; that of *Zizyphus* is acidulous, saccharine, and alimentary.

291. RHAMNUS CATHARTICUS, *Linn. L. E.*—COMMON BUCKTHORN.

Sex. Syst. Pentandria, Monogynia.
(*Fructûs succus, L.*—*Fruit, E.*)

HISTORY.—According to Dr. Sibthorp,¹ the *ῥαμνος* of Dioscorides is *Lycium europæum*. The earliest notice of *Rhamnus catharticus* is in *Tragus*.²

BOTANY. **Gen. Char.**—*Calyx* 4- to 5-cleft, often circumscissile in the middle after flowering; the base persistent under, and adherent with, the fruit. *Petals* alternate with the lobes of the calyx, or none. *Stamens* inserted opposite the petals. *Style* 2- to 4-cleft. *Fruit* almost juiceless, or baccate, 2- to 4-celled; *cells* in the juiceless fruit, separable, 1-seeded (rarely 2-seeded), dehiscing inwards by a longitudinal chink. *Seeds* oblong, marked at the external side by a deep groove, which is broader towards the base. (*De Cand.*)

Sp. Char.—Erect. *Leaves* ovate, toothed. *Flowers* fascicled, polygamous-dioecious. *Berries* 4-seeded, somewhat globose. (*De Cand.*)

A spreading *shrub* with terminal *spines*. *Leaves* with 4 or 6 strong lateral nerves parallel with the margin or rib. *Stipules* linear. *Flowers* yellowish-green; the *males* with broader *petals*, 4 *stamens* and 1 short *style*, without either ovary or stigma; the *females* smaller, with 4 *stigmas* projecting beyond the calyx, and rudimentary *stamens*. *Fruit* black, 4-celled.

Hab.—Indigenous; in hedges, groves, and thickets.—Flowers in May. The fruit is ripe in September.

COMPOSITION.—The expressed juice of buckthorn berries has been examined, chemically, by Vogel,³ and by Hubert.⁴

Vogel's Analysis.
Peculiar colouring matter.
Acetic acid.
Mucilage.
Sugar.
Nitrogenous matter.

Buckthorn Juice.

Hubert's Analysis.
Green colouring matter.
Acetic and malic acids.
Brown gummy matter.
Sugar.
Bitter substance (*cathartine*?).

Buckthorn Juice.

1. **PURGATIVE PRINCIPLE.**—The nature of the purgative principle of buckthorn requires farther elucidation. Hubert asserts that it possesses the properties of cathartine before described (see *Senna*); but his experiments are not conclusive. As from 25 to 30 berries are sufficient to purge, while an ounce of the juice is required to produce the same effect, it is probable that the greater part of the purgative principle resides in the marc left after the expression of the

¹ *Prodr. Fl. Græcæ*, i. 155.

² *Bull. de Pharm.* iv. 61.

³ See Sprengel, *Hist. Rei Herb.* ii. Præf. xi.

⁴ *Journ. de Chim. Méd.* vi. 193.

juice. [Winckler¹ has examined the substance called rhamicine, which Fleury obtained from the unripe berries. He considers that as the berries ripen, this principle becomes changed into cathartine and grape sugar.—Ed.]

2. COLOURING MATTER.—It is soluble in water, less so in alcohol, and insoluble in ether and oils. Acids redden it; whereas alkalies render it green. Vogel thinks its proper colour is green, and that it only becomes purple by the action of the acetic acid, which is developed in the ripe fruit. When the juice is evaporated to dryness with lime, it constitutes *sap-green*, or the *vert de vessie* of the French.

3. MUCILAGE.—The mucilage of buckthorn is of a peculiar nature. It disappears by fermentation. It is abundant in the recent juice, to which it gives consistence.

PHYSIOLOGICAL EFFECTS.—The berries, as well as their expressed juice, are powerful hydragogue cathartics; usually griping and causing great thirst, and sometimes operating with considerable violence. "Syrup of buckthorn," says Sydenham,² "purges in a manner only water, and evacuates a great quantity of it, and does not disturb the blood, nor render the urine high-coloured, as other purgatives usually do; and this syrup has but one ill property, viz.: that whilst it is working, it makes the sick very thirsty. But if you give the greatest dose of it to those that are difficultly purged, it will not give many stools, nor bring away so much water from them as it ought."

USES.—Buckthorn berries were formerly employed as cathartics, but their violent operation, and the sickness, griping, and thirst occasioned by them, have led to their disuse. "They be not meete to be ministered," says Dodoens,³ "but to young and lustie people of the countrie, which doe set more store of their money than their lives." The syrup is the only preparation now in use.

ADMINISTRATION.—Dose of the recent berries ʒj; of the dried ones ʒj; of the expressed juice fʒss to fʒj.

SYRUPUS RHAMNI, L. E.; *Syrup of Buckthorn*.—(Fresh Juice of Buckthorn Berries Oiv; Ginger, sliced, Allspice, bruised, of each ʒvj; Sugar lbvj; Rectified Spirit ʒvj. Set by the juice for three days, that the dregs may subside, and strain. To a pint of the clear juice add the Ginger and Allspice; then macerate for four hours with a gentle heat, and strain; boil down the residue to a pint and a half; mix the liquors; add the sugar, and dissolve; lastly, mix in the spirit.)—Cathartic. It is employed as an adjunct to purgative, and occasionally to diuretic mixtures. Sydenham found it, in one case, most beneficial in dropsy; and "with the juvenile confidence of an inexperienced man, verily believed," as he tells us, that he "had got a medicine that would cure any manner of dropsy;" but he found his "mistake in a few weeks."—Dose, ʒss to ʒj.

ORDER LXVIII. SIMARUBACEÆ, Lindley.—THE QUASSIA TRIBE.

SIMARUBEÆ, Richard.

CHARACTERS.—*Flowers* hermaphrodite, or rarely by abortion unisexual. *Calyx* 4- or 5-partite, persistent. *Petals* 4 or 5, hypogynous, erect, deciduous. *Stamens* equal in number, or twice as many as the petals, inserted on an hypogynous disk, free. *Ovary* with lobes as numerous as the petals; *style* 1, filiform, enlarged at the base. *Carpels* as many as the petals, articulated on the axis, capsular, bivalved, dehiscing inwardly, monospermous. *Seeds* exalbuminous, pendulous; *cotyledons* 2, thick; *radicle* short, superior.—*Trees* or *shrubs*, with a very bitter bark and milky juice. *Leaves* alternate, pinnate, without stipules (De Cand.)

PROPERTIES.—Bitterness is the prevailing quality of the order (see *Quassia*).

¹ *Jahrb. für prakt. Pharm.* Oct. 1849.

² *New Herbal*, by Lyte, p. 501, Lond. 1619.

³ *Works*, by Dr. Pechey, p. 391, 4th edit.

292. SIMARUBA AMARA, Aublet, E. D.—BITTER SIMARUBA, OR MOUNTAIN DAMSON.

Simaruba officinalis, De Cand.—*Quassia simaruba*, Linn.

Sex. Syst. Decandria, Monogynia.

(Root, E.—Cortex radicis, D.) [*Simaruba*, U. S.]

HISTORY.—*Simaruba* bark was first known to Europeans in 1713, when some of it was sent to Paris from Guiana, as the bark of a tree called by the natives *Simarouba*, which they employed with great success in dysentery. The first authentic botanical account of the tree was given by Dr. Wright.¹

BOTANY. **Gen. Char.**—*Flowers* unisexual. *Calyx* small, cup-shaped, 5-toothed or parted. *Petals* 5, longer, spreading. *Males*: stamens nearly equal to the petals, arranged around a receptacle bearing at its apex 5 very minute lobes (rudiments of ovaries), or sometimes none. *Females*: ovaries 5, placed on an even disk, surrounded at the base by 10 short hairy scales (rudiments of stamens). *Styles* the same number, short, distinct at the base; there united into 1, crowned by a broader 5-lobed stigma. *Fruit* 5 drupes (Lindley).

Sp. Char.—Male flowers decandrous. *Stigma* 5-partite. *Leaves* abruptly pinnate; *leaflets* alternate, somewhat stalked, pubescent beneath. (De Cand.)

A very tall tree. *Roots* long and creeping. *Stem* thick; bark bitter, internally white, fibrous and tough, externally blackish and furrowed in the old trees, but smooth and gray, with yellow spots, in the young ones. *Leaves* alternate; *leaflets* alternate, 2 to 9 on each side, oval, firm, mucronate. *Flowers* small, yellowish-white, some male, others female, mixed, in panicles. *Fruit* of 5 ovate, black, smooth capsules, placed on a fleshy disk.

Hab.—Guayana, Cayenne, Jamaica.

DESCRIPTION.—The *simaruba* bark (*cortex simarubæ*) of the shops is the bark of the root (*cortex radicis simarubæ*), and is brought from Jamaica in bales. It is odourless, but bitter, and occurs in broad, folded, very fibrous pieces, several feet long, which are externally rough, warty, and marked with transverse ridges. The epidermis is of a grayish or whitish-yellow colour; beneath it, the bark is darker, and yellowish-brown. On the inner surface, the bark is pale yellowish-white.

COMPOSITION.—*Simaruba* bark was analyzed by Morin,² who found in it the following substances: *Quassite*, a brittle resin, an aromatic volatile oil having the odour of benzoin, woody fibre, ulmin, an ammoniacal salt, malic acid, traces of gallic acid, malate and oxalate of lime, oxide of iron, and silica. No notice is taken of the mucilage, which, according to Pfaff,³ constitutes nearly one-fourth part of the bark.

PHYSIOLOGICAL EFFECTS.—In small doses, *simaruba* acts like the simple bitter tonics, whose effects have been already described. In full doses, however, it causes vomiting and purging, and is said also to promote perspiration and urine. Dr. Wright states that negroes are less affected by it than whites.

Desbois de Rochefort⁴ classed it among emetics; and Bichat proposed it as a substitute for ipecacuanha. It is, however, usually arranged with the tonics.

USES.—*Simaruba* may be employed in the same cases as other vegetable bitters. It has been principally celebrated in dysentery (whence the Germans call it *Ruhr-rinde*, or *dysentery-bark*) by Dr. Wright⁵ and others. It is, of course, only applicable in the latter stages of the acute and the asthenic and chronic forms of the disease. More recently, Dr. O'Brien⁶ has borne testimony to its good effects, when given in conjunction with opium, in epidemic dysentery. It has also been employed in the advanced stages of diarrhoea. Like other vegetable tonics, it may be ad-

¹ Trans. Royal Soc. of Edinb. vol. ii. part 2, p. 73.

² Syst. d. Mat. Méd. ii. 74.

³ Account of *Quassia Simaruba*.

⁴ Trans. of the King and Queen's College of Physicians, v. 237, Dublin.

⁵ Journ. de Pharm. viii. 57.

⁶ Cours Élément. de Mat. Méd. i. 357.

ministered in *dyspepsia*, *anorexia*, and *intermittents*. It is a remedy, however, which is seldom used.

INFUSUM SIMARUBÆ, E. D.; *Infusion of Simaruba Bark*.—(Simaruba Bark, bruised, ʒij [ʒij, D.]; Boiling Water Oj [fʒix, D.]. Macerate for two hours in a lightly-covered vessel, and strain [through linen or calico, E.].)—Tonic; in large doses emetic.—Dose, as a tonic, fʒj to fʒij.

293. PICRÆNA (*Quassia*) EXCELSA; Lindley, L. E. D.—THE LOFTY BITTER-WOOD TREE.

Quassia excelsa, Swartz.—*Picræna amara*, Wright.—*Quassia polygama*, Lindsay.

Sez. Syst. Decandria, Monogynia.

(*Lignum*, L. D.—The Wood, E.) [*Quassia*, U. S.]

HISTORY.—The wood of this tree has been introduced as a substitute for that of *Quassia amara*, with which it has often been confounded.

BOTANY. **Gen. Char.**—*Flowers* polygamous. *Sepals* 5, minute. *Petals* 5, longer than the sepals. *Stamens* 5, about as long as the petals, rather shaggy; *anthers* roundish. *Ovaries* 3, seated on a round, tumid receptacle. *Style* 3-cornered, bifid; *stigmas* simple, spreading. *Fruit* 3, globose, 1-celled, bivalved drupes, which are distant from each other, and placed on a broad hemispherical receptacle (Lindley).

Sp. Char.—The only species.

A tall, beautiful timber tree, sometimes 100 feet high. *Leaves* pinnate, with an odd one; *leaflets* 4 to 8 pairs, opposite, stalked, oblong, acuminate, unequal at the base. *Racemes* towards the ends of the branchlets, axillary, very compound. *Flowers* small, pale yellowish-green. *Drupe* size of a pea, black, shining, round.¹

Hab.—Jamaica.

DESCRIPTION.—*Quassia* wood (*lignum quassiae*)—sometimes called Jamaica quassia wood (*lignum quassiae jamaicensis*), in order to distinguish it from the wood of *Quassia amara*—is imported from Jamaica in billets of various sizes (sometimes a foot in diameter, and several feet in length), covered externally with a smooth brittle bark. The wood is white, but by exposure to the air becomes yellowish; it has no odour, but a most intensely bitter taste. Floors made of quassia wood retain for many years their bitterness. An efflorescence of nitrate of potash is frequently observed on it.²

ADULTERATION.—*Quassia* wood has recently been somewhat scarce, and, in consequence, its chips have been adulterated with the chips of other woods; but the intense bitterness of the genuine wood readily distinguishes it.

COMPOSITION.—Though quassia wood has been the subject of repeated chemical investigation, I am unacquainted with any complete analysis of it. But from the experiments of Pfaff³ and others, the following appear to me to be the principal constituents of it: *volatile oil* a minute trace, a *bitter principle* (quassite), *gummy extractive*, *pectin*, *wooly fibre*, and *various salts* (as oxalate, tartrate, and sulphate of lime, chlorides of calcium and sodium, an ammoniacal salt, and nitrate of potash).

QUASSITE; *Bitter Principle of Quassia*; *Quassin*.—Obtained by adding lime-water to a concentrated aqueous decoction of quassia (to separate the pectin and other substances), evaporating and treating the residue with alcohol, which takes up the quassite, a brown colouring matter, and some salts. By repeated solution and evaporation in alcohol, with a little ether, the quassite is obtained pure. Quassite occurs in small, white, prismatic crystals, which are fusible, odourless, intensely bitter, readily soluble in alcohol, but very slightly so in water or ether. Its solubility in water is increased by several salts and vegetable principles. Its watery solution is precipitated (white) by tannin, but not by iodine, chlorine, corrosive sublimate, salts of iron, acetate or diacetate of lead. It is a neutral body, though soluble in sulphuric and nitric acids. It consists of carbon 66.912, hydrogen 6.827, and oxygen 26.261; or C¹⁰H⁶O⁹.⁴

¹ Lindsay, *Trans. Roy. Soc. Edin.* iii. 205.

² Planche, *Journ. de Pharm.* xxiii. 542.

³ *Syst. d. Mat. Med.* ii. 21.

⁴ Wiggers, *Ann. d. Pharm.* xxi. 40; *Brit. Ann. of Med.* for 1837, p. 561.

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—From recent experiments it appears that quassia wood acts on animals as a narcotic poison. Dr. Wright¹ tells us that no insect will live near cabinet-work made of it. It has been long known that an aqueous infusion of this substance was an excellent fly-poison; but Hartl, one of Buchner's pupils, has lately shown that it also possesses poisonous properties with respect to the larger animals.² Thus he found that a rabbit, into a wound of whose thigh a grain of the alcoholic extract of quassia had been introduced, lost his strength and liveliness, and died on the third day. A second experiment, made on an older and stronger animal, was attended with the same results. No pain appeared to be experienced, nor were there any marks of irritation or inflammation observable after death. Kurtz³ mentions that complete paralysis of the hind extremities of a dog affected with the mange (*Fettrüde*) was brought on by washing the ulcers with decoction of quassia; in seven hours, however, it disappeared.

These experiments seem to show that the bitter principle of quassia possesses poisonous properties, somewhat like those of the *Amer* of Welther.

3. On Man.—In the usual medicinal doses, quassia operates as a stomachic and tonic—that is, it is bitter to the taste, promotes the appetite, and assists the digestive functions. It is devoid of all irritant, stimulant, and astringent properties; and has been, therefore, sometimes taken as a type of the simple or pure bitters. It is more powerful than, but in other respects analogous to, gentian in its operation. "We can find nothing in this wood," says Dr. Cullen,⁴ "but a pure and simple bitter;"—and he goes on to observe that he believes it to be an excellent substance, capable of doing all that any pure and simple bitter can do, but no more.

Does it act as a narcotic on man, as on other animals? I have employed, and seen others administer quassia most extensively, but never had grounds for suspecting any effect of the kind alluded to. Yet some have observed effects which certainly seem to favour the notion that quassia possesses a specific influence over the cerebro-spinal system. In females endowed with extreme susceptibility, I have seen, says Barbier,⁵ involuntary movements of the arms and legs produced by the aqueous infusion of quassia. Kraus⁶ says that the continued use of quassia brings on amblyopia (dimness of sight); and Kurtz asserts that the long-continued use of quassia has brought on amaurosis.

Like many other substances, quassia, mixed with dead animal matter, checks putrefaction, and hence it is termed antiseptic. Ebeling,⁷ many years ago, performed some experiments to determine its power in this respect, compared with other bitters, and found it much superior to several of them.

USES.—Quassia is employed in the same cases as several other simple bitters; some of which have been already noticed. Though I am not disposed to place much confidence in the above-quoted statements of Barbier, Kraus, and Kurtz, yet a cautious practitioner would avoid employing it in amaurosis and cerebral affections. Quassia is principally employed in *dyspepsia*, *anorexia*, and other stomach disorders of a functional kind of an atonic character, more especially when occurring in a gouty subject. Though it has been beneficially employed in *intermittents*, few practitioners will, I suspect, use it, when they can procure cinchona, quina, or arsenic.

Kraus suggests that it may be useful in intolerance of light, and other diseases of the eye, accompanied with great sensibility without fever or congestion; yet only (he adds) as an adjuvant to hyoseyamus and belladonna.

An infusion of quassia has been proposed as a wash in compound fractures, wounds, and ulcers, to keep off insects. In its use, however, we should bear in mind the effect which Kurtz states was produced on a dog by a wash of this kind.

1. INFUSUM QUASSIÆ, L. E. D. [U. S.]; *Infusion of Quassia.*—(Quassia Wood,

¹ *Med. Plants of Jamaica.*

² G. A. Richter, *Ausf. Arzneimittell.* Suppl. Bd. S. 42, 1832.

³ *Traité Élém. de Mat. Méd.* 2de edit. i. 250.

⁷ Schlegel, *Thes. Mat. Méd.* t. ii.

² Buchner, *Toxicol.* S. 266.

⁴ *Mat. Méd.*

⁶ *Heilmittel.* S. 412, 1831.

in chips, 3ij [3j, *E. D.*]; Boiling [distilled, *L.*] Water Oj [f3viii, *D.*]. Macerate for two hours in a lightly covered vessel, and strain [through linen or calico, *E.*]. [Infuse one hour, *D.*]. [Quassia, rasped, 3ij; Water Oj. Macerate for twelve hours, and strain.]—Tonic. Generally employed in dyspeptic and other stomach affections. It has an advantage over some other vegetable bitter infusions, that chalybeates can be combined with it, without changing its colour.—Dose, f3j to f3iij. It is in common use as a fly-poison.

2. *TINCTURA QUASSIÆ*, *E.* [*U. S.*]; *Tincture of Quassia*.—(Quassia in chips, 3x [rasped, 3ij]; Proof Spirit Oij [Alcohol Oij]. Digest for seven [fourteen] days, and filter.)—Dose, f3ss to f3ij. This tincture possesses all the bitterness of the wood.

3. *TINCTURA QUASSIÆ COMPOSITA*, *E.*; *Compound Tincture of Quassia*.—(Cardamom Seeds, bruised, Cochineal, bruised, of each 3ss; Cinnamon, in moderately fine powder; Quassia, in chips, of each 3vj; Raisins 3vij; Proof Spirit Oij. Digest for seven days, strain the liquor, express strongly the residuum, and filter. This tincture may also be obtained by percolation, as directed for the Compound Tincture of Cardamom, provided the quassia be rasped or in powder.)—An aromatic tonic.—Dose, f3j to f3ij.

OTHER MEDICINAL SIMARUBACEÆ.

The wood of *QUASSIA AMARA* (Linn. *E.*) has been employed in medicine under the name of Surinam quassia wood (*lignum quassiæ surinamense*). Fermin mentions that, about the year 1714, the flowers of this shrub were highly valued at Surinam, on account of their stomatic properties. In 1730, the root is said to have been found in the collection of Seba, a celebrated spice-dealer of Amsterdam. Haller tells us that a relative of his took quassia for an epidemic fever in 1742, and that it was then a well-known medicine. In 1763, Linnæus published a dissertation on this medicine, in which he states that he received specimens of the tree from one of his pupils, C. D. Dahlberg, a military officer and counsellor at Surinam, who had become acquainted with the medical properties of the root through a black slave named Quassia, who employed it as a secret remedy in the cure of endemic malignant fevers of that place. From this circumstance, Linnæus named the tree in honour of the slave, *Quassia*. Rolander, who returned from Surinam in 1756, tells us he saw and conversed with this black, who was almost worshipped by some, and suspected of magic by others. Rolander found him to be a simple man, better skilled in old women's tales than in magic.¹ All parts of the plant are intensely bitter. The wood, as I have received it, is in cylindrical pieces (covered by a thin, grayish-white, and bitter bark) not exceeding two inches in diameter, very light, without odour, but having an extremely bitter taste. The chemical and medical properties are similar to the wood of *Simaruba amara*.

ORDER LXIX. RUTACEÆ, *De Candolle*.—THE RUE TRIBE.

CHARACTERS—*Sepals* 3, 4, or 5; more or less adherent at the base, so that the calyx is dentate, cleft, or partite. *Petals* very rarely 0, usually as many as the sepals, frequently unguiculate, distinct. *Disk* fleshy-glandular, surrounding the ovary, arising from the receptacle external to the petals, and bearing the stamens on the upper part. *Stamens* usually twice as many as the petals, and then either all fertile or the alternate ones barren. *Carpels* as many as the sepals, sometimes fewer by abortion, either distinct or united at the base, or perfectly connate. *Style* arising from the centre of the ovary, single, divided into as many stigmas as there are ovaries. *Carpels*, when ripe, generally distinct, one-celled, dehiscent, bivalved, cocculose within. *Seeds* affixed to the inner angle, inverse; *embryo* straight, compressed; *radicle* superior.—*Herbs* or *shrubs*, with opposite or alternate stipulate leaves (Condensed from *De Candolle*).

PROPERTIES.—Volatile oil and bitter matter are the predominating constituents of this order. These confer stimulant, tonic, and, in some cases, narcotic qualities.

294. *RUTA GRAVEOLENS*, *Linn. L. E.*—COMMON OR GARDEN RUE.

Sex. Syst. Decandria, Monogynia.
(*Folium, L.*—Leaves and unripe fruit, *E.*)

HISTORY.—This plant was highly esteemed by the ancients; and is frequently

¹ Murray, *App. Med.* iii. 433.

mentioned by Hippocrates under the name of *Πύραρον*. Pliny¹ says that Pythagoras (who died in the year 489 before Christ) fancied that rue was hurtful to the eyes; but, adds Pliny, he was in error, since engravers and painters eat it with bread or cresses to benefit their eyes. The ancients had a curious idea that stolen rue flourished the best; just as, says Pliny, it is said that stolen bees thrive the worst.

BOTANY. Gen. Char.—*Calyx* persistent, 4-, rarely 3- to 5-partite. *Petals* as many as the segments of the calyx, unguiculate, somewhat cochleate. *Stamens* twice as many as the petals. *Nectariferous pores* at the base of the ovary, as many as the stamina. *Ovary* on a short, thick stalk. *Style* 1. *Capsule* somewhat globose, divided into as many cells as there are petals. *Seeds* affixed by the internal angle; *albumen* fleshy; *embryo* curved; *radicle* long; *cotyledons* linear.—Perennial or suffruticose, fetid herbs, of a sea-green colour. *Leaves* alternate. *Flowers* corymbose, yellow, central, often 5-cleft. (De Cand.)

Sp. Char.—*Leaves* supradecomposed; lobes oblong, the terminal one obovate. *Petals* entire or somewhat toothed. (De Cand.)

A small, branching, hairless undershrub, with the lower part only of the stem woody. *Leaves* dotted, glaucous or bluish-green. *Flowers* in umbellate racemes. *Petals* 4 or 5, unguiculate, concave, yellow. The first flower has usually ten stamina, the others eight. It is remarkable that the anthers move in turns to the pistillum, and, after having shed their pollen, retire. *Fruit* roundish, warted, 4-lobed, each lobe opening into two valves.

Hab.—South of Europe. Commonly cultivated in gardens.

DESCRIPTION.—The herb (*herba rutæ*; *herba rutæ hortensis*) is readily recognized by its strong disagreeable odour, which it owes to volatile oil. Its taste is bitter and nauseous. 100 lbs. yield by drying about 22 lbs. The dried herb is grayish-green, and has a less powerful odour. The unripe fruit (*fructus immaturus rutæ*) is also official in the Edinburgh Pharmacopœia.

COLLECTION.—Rue was analyzed, in 1811, by Mühl,² who found in it the following constituents: *Volatile oil*, *bitter extractive*, *chlorophylle*, *peculiar vegeto animal matter* precipitable by tincture of nutgalls, *malic acid*, *gum*, *albumen*, *starch*, and *woody fibre*.

1. **VOLATILE OIL**—(See p. 877.)

2. **BITTER EXTRACTIVE.**—Very bitter, insoluble in alcohol and ether.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally.*—Orfila³ found that eighteen grains of oil of rue, injected into the veins of a dog, acted as a narcotic, and caused staggering and feebleness of the posterior extremities; but in a few hours the animal had recovered. Six ounces of the juice of rue, introduced into the stomach of a dog, killed it within twenty-four hours. The mucous membrane of the stomach was found inflamed.

β. On Man.—The topical action of rue is that of an acrid. When much handled, it is apt to cause redness, swelling, and vesication of the skin. The following is an illustrative case of Buchner:⁴ After some very hot days in June, 1823, Roth, an apothecary at Aschaffenburg, cut down a considerable quantity of rue while in full bloom, and separated the leaves from the stalks. The next morning both his hands were very red, and hot, and, on the third day, appeared as if they had been exposed to hot aqueous vapour. They were besmeared with oil. Towards evening, vesication commenced, and was most copious at the points of the fingers. On the fourth day, the parts were still much swollen; and, between the blisters, the skin had assumed a dark red or purplish hue. On the fifth and sixth days, the swelling extended up the back part of the arms as far as the elbow. Poultices (of chamomile and elder flowers) were applied, and the blisters cut. Within four weeks the skin had gradually peeled off. His children, who had played with the rue, suffered from swelling of the face and hands.

¹ *Hist. Nat. lib. xx. cap. 51, ed. Valp.*

² *Toxicol. Gén.*

³ *Pfaff, Mat. Med. iv. 339.*

⁴ *Toxikologie*, 265.

The constitutional effects of rue are those of a stimulant and narcotic. It has long been celebrated as an antispasmodic in epilepsy, hysteria, and flatulent colic. It is a very popular emmenagogue, especially in hysterical cases; and is sometimes resorted to for the purpose of procuring abortion. Its narcotic and reputed uterine influence seems to be proved by three cases of poisoning with it, taken for the purpose of causing miscarriage, published by Helie.¹ In these cases, the rue produced the effects of an acro-narcotic poison—viz., epigastric pain, violent and continued vomiting, inflammation and swelling of the tongue, salivation, colic, fever, thirst, disorder of the muscular system (manifested by tottering gait, and irregular and convulsive movements of the body and limbs), giddiness, confused vision, contracted pupil, delirium, or rather reverie, somnolency, and, after some days, miscarriage. During the stupor, the pulse was feeble, very small, and slow (in one case beating only thirty times in the minute); there were great debility, faintness, and coldness of the skin. The general appearance was that of an intoxicated person. The ill effects lasted several days. In one case, a decoction of fresh sliced roots, as big as the finger, had been taken; in the second, a decoction of the leaves; in the third, a large dose of the expressed juice of the fresh leaves.

USES.—Rue is comparatively but little employed by the medical practitioner. It formerly enjoyed great celebrity as an antispasmodic and emmenagogue; a celebrity which it still retains among the public. The observations above made on the effects of rue prove that it is a much more active agent than is commonly supposed, and its remedial powers deserve to be more carefully examined than they have hitherto been. In the *flatulent colic*, especially of children, it is an exceedingly valuable remedy, and may be administered either by the stomach, or, in infants, by the rectum, in the form of clyster. It may also be employed with benefit in some cases of *infantile convulsions*. It has been employed in *hysteria*, *amenorrhœa*, and *epilepsy*. In the first two of these maladies, it will probably at times prove serviceable, and in them it deserves farther trials. It has likewise been used as an *anthelmintic*. In former times it was eaten as a *condiment*, and was regarded as a universal *antidote* to poisons. It has been employed topically as an *antiseptic* in gangrene and foul ulcers, and likewise as a *local stimulant*, *rubefacient*, and *dis-cutient*, in cold swellings, contusions, &c.

ADMINISTRATION.—Dose of the *powder*, from ℥j to ℥ss; but this is not an eligible mode of preparation, as rue loses part of its activity (by the volatilization of its essential oil) by drying. An *infusion* (prepared by digesting an ounce of the fresh herb in Oj of boiling water), called *rue tea*, is a popular remedy. It is given in doses of f℥j to f℥ij. *Rue water* (*aqua rutæ*) may be prepared with the oil, as *mint water*; its dose is f℥j to f℥ij.

1. **CONFECTIO RUTÆ, L.**; *Confection of Rue*.—(Fresh Rue, Caraway, Bay Berries, of each ℥iss; Sagapenum, powdered, ℥ss; Black Pepper ℥ij; Prepared Honey ℥xvj; Distilled Water as much as may be sufficient. Rub the dry ingredients into a very fine powder; then add the powder by degrees to the sagapenum, melted in the honey and water by a slow fire.)—Carminative and antispasmodic. Employed in flatulent colic and infantile convulsions. Objectionable in inflammation of the intestinal mucous membrane. Dose, ℥j to ℥j. Sometimes employed in the maladies of children in the form of enema, composed of gruel and a scruple of the confection.

2. **OLEUM RUTÆ, E.**; *Oil of Rue*.—(Obtained by submitting the herb, with water, to distillation.)—From 12 lbs. of the leaves, gathered before the plant had flowered, Lewis² obtained only about ℥iij of oil; but the same quantity of herb, with the seeds almost ripe, yielded above ℥j. It is pale yellow, has a bitterish acrid taste, and a sp. gr. of 0.911. It is somewhat more soluble in water than the other volatile oils. It is stimulant, antispasmodic, and emmenagogue. Used in spasmodic

¹ *Lond. Med. Gaz.* xxiv. 171.

² *Mat. Med.*

and convulsive diseases, and in amenorrhœa.—Dose, gr. ij to vj rubbed down with sugar and water.

3. **SYRUPUS RUTÆ**; *Syrup of Rue*.—Though syrup of rue is not contained in any of the British pharmacopœias, it is a useful preparation, and is always kept in the shops. It is usually prepared extemporaneously by adding eight or ten drops of the oil to a pint of simple syrup. It is used by nurses to relieve the flatulent colic of children.—Dose, one or two teaspoonfuls.

295. BAROSMA, Willdenow.—VARIOUS SPECIES, L. E.

Barosma serratifolia; *B. crenulata*, Willd.—*Barosma crenata*, De Cand. Willd. Eckl. D.
Sex. Syst. Pentandria, Monogynia.

(Folium, L.—Leaves, E.—Folia, D.) [Buchu, U. S.]

HISTORY.—The natives of the Cape of Good Hope employ several species of *Barosma*, on account of their odoriferous and medicinal properties. The Hottentots employ a powder, composed of the leaves of various odoriferous plants (principally *Barosmas*), under the name of *Bookoo* or *Buku*, for anointing their bodies.¹ *Barosma crenata* was introduced into the botanical gardens of this country in 1774, but it was not employed in medicine till 1823.

BOTANY. **Gen. Char.**—*Calyx* 5-cleft or parted; dotted. *Disk* lining the bottom of the calyx generally with a short, scarcely prominent rim. *Petals* 5, with short claws. *Filaments* 10; the five opposite the petals sterile, petaloid, sessile, ciliated, obscurely glandular at the apex; the other five longer, smooth or hispid, subulate, with the anthers usually furnished with a minute gland at the apex. *Style* as long as the petals. *Stigma* minute, 5-lobed; *ovaries* auriculate at the apex, usually glandular and tuberculated. *Fruit* composed of 5 cocci covered with glandular dots at the back (Lindley).—*Shrubs*. *Leaves* opposite, flat, smooth, dotted. *Flowers* stalked, axillary.

Species.—The leaves of several species of *Barosma* constitute *Buchu* or *Bucku*.

1. **BAROSMA CRENULATA**, Willd.; *Diosma crenulata*, Linn.; *D. odorata* (De Cand.); *D. latifolia*, Loddiges; *D. serratifolia*, Burchell.—*Leaves* ovate-oblong, crenate, smooth, glandular. *Pedicels* solitary, with two bracts immediately under the flower. (De Cand.)—Upright *shrub*, between 2 and 3 feet in height; branches brownish-purple. *Leaves* about an inch long, oval-lanceolate, on very short petioles, very obtuse, delicately and minutely crenated, quite glabrous, rigid, darkish-green, and quite smooth above, with a few very obscure oblique nerves; beneath paler, dotted with glands which are scarcely pellucid, while at every crenature is a conspicuous pellucid gland; there is also a narrow pellucid margin round the whole leaf. *Peduncles* about as long as the leaf. *Calyx* of 5 ovate-acuminate leaflets, green, tinged with purple. *Corolla* of 5 ovate petals, purple in bud, bluish-coloured when fully expanded (Condensed from Hooker²).—Cape of Good Hope.

2. **BAROSMA CRENATA**, Ecklon and Zeyher;³ *Diosma crenata*, De Candolle, Loddiges, L. D.—*Leaves* ovate [or obovate] acute, dotted, glandulose-serrate at the margin. *Pedicels* solitary, somewhat leafy. (De Cand.)—*Flowers* pink, terminal, on short leafy branches.—Cape of Good Hope.

3. **BAROSMA SERRATIFOLIA**, Willd., De Candolle, Loddiges.—*Leaves* linear-lanceolate, serrulate, smooth, glandular. *Pedicels* solitary, bearing two leaflets above the middle. (De Cand.) *Leaves* acuminate, 3-nerved. *Flowers* lateral, white.—Cape of Good Hope.

DESCRIPTION.—The leaves of several species of *Barosma* are known in the shops as *Buchu* (*Bucku*, E.; *Folia Barosmæ* seu *Diosmæ*). They are intermixed with stalks and fruit. They are smooth, somewhat shining, sharply or bluntly serrated or crenated, and beset both on the edges, especially between the teeth, and on the

¹ Burchell, *Travels in Southern Africa*, i. 479; and ii. 59.

² *Bot. Mag.* t. 3413.

³ *Enum. Pl. Afr. austr.* i. 102, 1905.

under surface, with glands filled with essential oil. Their consistence is coriaceous; their colour pale or yellowish-green; their odour strong and rue-like (though some compare it to rosemary, others to cumin, or cat's urine), and their taste is warm and mint-like. They present considerable variety in shape. The most common are the following :—

a. *Ovate or obovate Buchu.* Leaves of *Barosma crenata*, Eckl. and Zeyher.—Leaves ovate, oval, oblong, or obovate.

b. *Ovate-oblong Buchu.* Leaves of *Barosma crenulata*, Willd.—Leaves ovate-oblong, or obovate-oblong, or oval-lanceolate, obtuse.

c. *Linear lanceolate Buchu.* Leaves of *Barosma serratifolia*, Willd.—Leaves linear-lanceolate, acuminate.

COMPOSITION.—Two analyses of buchu have been made: one, in 1827, by Brandes;¹ the other, in the same year, by Cadet de Gassicourt.²

Brandes's Analysis.

Pale yellow volatile oil	0.89
Resin	2.34
Bitter extractive (<i>Diosmin</i>)	3.78
Chlorophylle	4.77
Gum	12.71
Lignin	45.00
Brown substance extracted by potash	1.56
Nitrogenous matter extracted by potash	2.42
Albumen	0.58
Mulic acid, and matter precipitable by tannin	1.56
Bassorin, with oxalate and phosphate of lime	4.53
Various salts of potash and lime	3.07
Water	12.94
Acetic acid and loss	3.86

Leaves of *Diosma crenata* 100.00

Cadet's Analysis.

Volatile oil	0.665
Gum	21.170
Extractive	5.170
Chlorophylle	1.100
Resin	2.151
[Lignin, &c.]	69.744

Leaves of *Diosma crenata* 100.000

1. **VOLATILE OIL OF BUCHU** (*Oleum Barosmæ* seu *Diosmæ*).—Yellowish-brown, lighter than water; odour that of the leaves.

2. **BITTER EXTRACTIVE;** *Diosmin*.—Brownish-yellow, bitter, and somewhat pungent. Soluble in water; but neither in alcohol or ether.

PHYSIOLOGICAL EFFECTS.—Buchu is an aromatic stimulant and tonic. Taken in moderate doses it promotes the appetite, relieves nausea and flatulence, and acts as a diuretic and diaphoretic. Its constitutional effects appear referable—first, to its action on the stomach; and, secondly, to the absorption of the volatile oil, which is subsequently thrown out of the system by the secreting organs, on which it appears to act topically in its passage through them. Buchu seems to have a specific influence over the urinary organs.

USES.—The natives of the Cape of Good Hope prepare a spirit of buchu (which they term *buchu brandy*), by distilling the leaves with the dregs of wine, which they employ in chronic diseases of the stomach and bladder.

In this country, buchu has been principally employed in *chronic maladies of the urino genital organs*. Dr. Reece³ first drew the attention of practitioners and the public in this country to it in these cases; and in 1823, Dr. M'Dowell⁴ gave a most favourable account of its good effects. It has since been employed by a considerable number of practitioners, and its remedial powers fairly tried. It seems to be principally adapted to chronic cases attended with copious secretion. In *chronic inflammation of the mucous membrane of the bladder*, attended with a copious discharge of mucus, it frequently checks the secretion, and diminishes the irritable condition of the bladder, thereby enabling the patient to retain his urine for a longer period; but I have several times seen it fail to give the least relief, and in some cases it appeared rather to add to the patient's sufferings. In *irritable conditions of the urethra*, as spasmodic stricture, and in *gleet*, it has occasionally proved serviceable. In *lithiasis*, attended with increased secretion of uric acid, it has been given with considerable benefit by Dr. Carter⁵ and others, and has appeared to

¹ Gmelin, *Handb. d. Chem.* ii. 1256.

² *Gazette of Health*, for 1821, 1822, 1823, and 1824.

³ *Trans. of the King and Queen's College of Physicians*, iv. 131, Dublin, 1824.

⁴ *Lond. Med. Rep.* April, 1826, p. 348.

⁵ *Journ. de Chim. Méd.* iii. 44.

check the formation of this acid. For the most part, it should be given in these cases in combination with alkalies (as liquor potassæ). In *prostatic affections*, in *rheumatism*, and even in *skin diseases*, it has also been employed, and, it is said, with good effect. In *dyspepsia*, Dr. Hulton has found it serviceable.¹

ADMINISTRATION.—The dose of buchu, in *powder*, is ʒj or ʒss. It is usually taken in wine. But the *infusion* and *tincture* are more eligible preparations.

1. INFUSUM BUCHU, L. D. [U. S.]; *Infusum Bucku*, E.; *Infusion of Buchu*.—(Buchu ʒj [ʒss, D.]; Boiling [distilled, L.] Water Oj [Oss, D.]. Macerate for four [two, E.; one hour, D.] hours in a lightly-covered vessel, and strain [through calico, E.]—Tonic, sudorific, and diuretic.—Dose, fʒj to fʒij.

2. TINCTURA BUCHU, D.; *Tinctura Bucku*, E.; *Tincture of Buchu*.—(Buchu ʒv; Proof Spirit Oij. Digest for seven days, pour off the clear liquor, and filter. This tincture may be conveniently and quickly made also by the process of percolation, E.—The proportions used by the *Dublin College* are essentially the same, and the tincture is directed to be prepared by maceration.)—Dose, fʒj to fʒiv.

296. GALIPEA OFFICINALIS, Hancock, E.; and GALIPEA CUSPARIA, De Candolle, L.

Sex. Syst. Diandria, Monogyn'a.

(Cortex, L.—Bark, E.)

[Angustura, U. S.]

HISTORY.—Mutis is said to have employed Angostura bark in 1759; but it did not come to England until 1788, and was first publicly noticed in the *London Medical Journal* for 1789. Mr. A. E. Brande² says that, in 1791, 40,000 lbs. or upwards had been imported. It was called *Cortex Angusturæ*, from Angostura, a place in South America, whence the Spaniards first brought it.

BOTANY. Gen. Char.—*Calyx* short, 5-toothed. *Petals* 5, united into a salver-shaped corolla, or closely approximating; tube short, pentagonal; lobes spreading, acute. *Stamens* 4 to 7, hypogynous, somewhat adherent to the petals, unequal, sometimes all fertile, commonly two antheriferous, two to five shorter, sterile. *Nectary* cupuliform. *Styles* 5, afterwards combined into 1, and forming a 4- or 5-grooved stigma. *Carpella* 5, or by abortion fewer, containing two ovules, obtuse, cocculiform, sessile, with a separable endocarp. *Seeds* solitary by abortion; *cotyledons* large, corrugated, biauriculate.—Smooth shrubs. *Leaves* alternate, simple, or plurifoliate; leaflets oblong, acuminate. *Peduncles* axillary, many flowered. (De Cand.)

Species.—Humboldt and Bonpland³ state that *Galipea Cusparia*, De Cand. yields Angostura bark; whereas Dr. Hancock⁴ asserts that it is a species which he calls *Galipea officinalis*. But it appears to me not improbable that both species may yield a febrifuge bark.

1. GALIPEA CUSPARIA, De Cand. L.; Bonplandia trifoliata, Willd. D.; Cusparia febrifuga, Humb. and Bonpl.—*Leaves* trifoliate. *Racemes* stalked, almost terminal. *Calyx* 5-toothed. *Sterile stamens* 3. (De Cand.)—A majestic forest tree, 60 or 80 feet high. *Leaves* 2 feet long, gratefully fragrant; petioles 1 foot long, or nearly so; leaflets sessile, unequal, ovate-lanceolate, acute. *Flowers* white, with fascicles of hairs seated on glandular bodies on the outside. *Stamens* monadelphous (Kunth); fertile ones, 2; sterile ones, 3, according to Roemer—4 according to Kunth; *anthers* with two short appendages. *Stigmas* 5. *Seed* solitary.—Forests of tropical America. Yields Angostura bark (Humboldt and Bonpland).

2. GALIPEA OFFICINALIS, Hancock, E.—*Leaves* trifoliate. *Racemes* stalked, axillary, terminal. *Stamens* 2. *Nectaries* (sterile stamens?) 5 (Hancock).—A tree, usually 12 or 15 feet high, never exceeding 20 feet. *Leaves*, when fresh,

¹ M'Dowell, *op. cit.*

² *Pl. Æquinoct.* ii. 59, t. 57.

³ *Exp. and Observ. on the Angustura Bark*, Lond. 1793.

⁴ *Trans. Med. Bot. Soc.* 1829, p. 16.

having the odour of tobacco ; leaflets oblong, pointed at both extremities, from 6 to 10 inches long, on very short stalks ; petioles as long as the leaflets. *Flowers* white, hairy. *Stamens* distinct ; fertile ones, 2 : sterile ones, 5 ; *anthers* without appendages. *Stigma* simple, capitate. *Seeds* 2 in each capsule ; 1 usually abortive. Neighbourhood of the Orinoko (Carony, Alta Gracia, &c.) Yields *Angostura* or *Carony bark* (Hancock).

DESCRIPTION.—*Angostura* or *Cusparia bark* (*cortex angosturæ seu cuspariæ*) is imported directly or indirectly from South America. “The most of what I have seen,” says Mr. A. E. Brande, “has been put into casks in the West Indies ; but where the original package remains it is very curious, and formed carefully of the large leaves of a species of palm, surrounded by a kind of network made of flexible sticks.” It occurs in flat pieces and quills, of various sizes, the longest pieces being from six to ten inches in length, covered with a yellowish-gray or grayish-white spongy epidermis, easily scraped off by the nail. The internal surface is brownish, not quite smooth, somewhat fibrous or splintery, easily separable into laminæ ; the fracture is short and resinous ; the odour strong but peculiar, and somewhat animal ; the taste bitter, aromatic, and slightly acid.

SUBSTITUTION.—I have already noticed the serious accidents which have resulted in consequence of the bark of the nux-vomica tree being substituted, either from ignorance or commercial cupidity, for *angostura bark*. Hence arose the distinction into *true* or *West India angostura*, and *false, spurious, or East India angostura*. Though the characters of the latter have been fully described, it may be as well to place them in contrast with those of the genuine *angostura*. In drawing up the following table of characteristics, I have been greatly assisted by the tables of Guibourt¹ and Fée.²

	<i>Angostura Bark.</i>	<i>Nuz Vomica (False Angostura) Bark.</i>
<i>Form</i>	Quills or flat pieces, straight or slightly bent.	Quills or flat pieces, short, often very much twisted, like dried horn, arched backwards.
<i>Odour</i>	Disagreeable.	None, or very slight.
<i>Taste</i>	Bitter, afterwards somewhat acid, persistent.	Intensely bitter, very persistent.
<i>Hardness and Density</i> . .	Bark fragile when dry, easily cut; light, tissue not very dense.	Broken or cut with difficulty, heavy, tissue compact.
<i>Fracture</i>	Dull and blackish.	Resinous.
<i>Epidermoid crust</i>	Whitish or yellowish, insipid, unchanged, or rendered slightly orange-red by nitric acid.	Variable; sometimes a spongy rust-coloured layer; at other times whitish, prominent spots, more or less scattered or approximated. Nitric acid makes it intensely dark green or blackish.
<i>Inner surface</i>	Separable into laminæ ; deepened by nitric acid.	Not separable into laminæ ; rendered blood-red by nitric acid.
Infusion of the bark prepared by digesting 1 part of bark in 24 parts of water.	<i>Tinct. of Litmus</i>	Slightly reddened.
	<i>Sesquichl. Iron</i>	Clear yellowish-green liquor.
	<i>Ferrocyanide of Potassium</i>	Slight turbidness not augmented by hydrochloric acid ; liquor greenish.
	<i>Nitric Acid</i> . .	A small quantity makes the liquor clear and paler ; a large quantity transparent red.

COMPOSITION.—*Angostura bark* has been the subject of repeated chemical investigation. Notices of the earlier attempts to analyze it are given by Meyer³ and Pfaff.⁴ The analyses which deserve quoting are those of Pfaff⁵ and Fischer.⁶

¹ *Hist. des Drog.* 3me édit. ii. 6.

² *Diss. Inaug. de Cort. Angust.* Gotting. 1790.

³ *Ibid.*
⁴ *Cours d'Hist. Nat. Pharm.* i. 588.

⁵ *Syst. der Mat. Med.* ii. 58.

⁶ *Gmelin, Hand. d. Chem.* ii. 1258.

Pfaff's Analysis.		Fischer's Analysis.	
Volatile oil.		Volatile oil	0.3
Bitter extractive.		Peculiar bitter principle	3.7
Bitter resin.		Bitter hard resin	1.7
Acrid oily resin.		Balsamic soft resin	1.9
Tartaric acid (free).		Elastic resin	0.2
Salts (sulphate and tartrate of potash, chloride of potassium, and sulphate of lime).		Gum	5.7
Lignin.		Lignin	59.1
Angostura bark.		Angostura bark	102.6

1. **VOLATILE OIL**; *Odorous Principle of Angostura*.—Obtained by submitting the bark to distillation with water. It is yellowish-white, lighter than water, has the peculiar odour of the bark, and an acrid taste. To this, as well as to the resin, the bark owes its acrid, aromatic taste.¹

2. **ANGOSTURIN**; *Cusparin*, *Saladin*; *Bitter Extractive*, Pfaff; *Peculiar Bitter Principle*.—A neutral principle obtained by Saladin² in the form of tetrahedral crystals, by submitting the alcoholic tincture of the bark (prepared without heat) to spontaneous evaporation. When heated it fuses, loses 23.09 per cent. of its weight, and subsequently inflames, without giving any evidence of its being volatile or nitrogenous. It is insoluble in the volatile oils and in ether; but dissolves slightly in water, more so in alcohol. Alkaline solutions also dissolve it. Nitric acid renders it greenish-yellow; sulphuric acid reddish-brown. Tincture of nutgalls precipitates it from its aqueous and alcoholic solutions.

3. **RESIN**.—The *hard resin* is brown, bitter, soluble in potash, alcohol, and acetic ether; but insoluble in sulphuric ether and oil of turpentine. The *soft resin* is acrid, greenish-yellow, soluble in alcohol, ether, oil of turpentine, and almond oil; but insoluble in a solution of potash. It is coloured red by nitric acid.³

PHYSIOLOGICAL EFFECTS.—A powerful aromatic or stimulant tonic (see the effects of the *aromatic bitters*). Its aromatic or stimulant properties depend on the volatile oil and resin; its tonic operation, on the bitter principle. In its tonic and febrifuge powers it approximates to cinchona bark, but is devoid of astringency. It is less likely to irritate the stomach or to cause constipation than cinchona; but usually keeps the bowels gently open. In full doses, it is capable of nauseating and purging. Dr. Hancock says the warm infusion causes sweating and diuresis. In its combination of tonic and aromatic properties, it is most allied to cascarilla. In its stomachic qualities it approaches calumba.

USES.—Angostura bark is but little employed by practitioners of this country. We may fairly ascribe this in part to the serious consequences which have resulted from the use of the false angostura, and in part to the belief that we have other remedies of equal, if not of superior, efficacy to it. In some of the continental States, its employment has been prohibited. It may be administered as a febrifuge in *intermittents and remittents*, especially in the worst forms of the bilious remittents of tropical climates. Drs. Williams,⁴ Wilkinson,⁵ Winterbottom,⁶ and, more recently, Dr. Hancock, have spoken in the highest terms of its efficacy. In some of these cases, it is said to have proved greatly superior to cinchona. It sits more readily on the stomach, and does not cause constipation like the latter, but keeps the bowels gently open. In *adyamic continued fever*, especially when complicated with great disorder of the digestive organs (manifested by vomiting or purging), it has been used with good effect.⁷ As an aromatic tonic and stomachic, in *general relaxation and muscular debility*, and in *atonic conditions of the stomach and intestinal tube* (as some forms of dyspepsia, anorexia, &c.), it has been employed with great success. It has also been administered to *check profuse mucous discharges*, as in the latter stages and chronic forms of dysentery and diarrhoea, and in chronic bronchial affections attended with excessive secretion of mucus. In fine, angostura is applicable to any of the purposes for which other vegetable tonics (especially cascarilla, calumba, and cinchona) are commonly employed.

ADMINISTRATION.—It may be given in *powder*, in doses of from grs. x to ʒss. But the *infusion* and *tincture* are better preparations.

¹ Pfaff, *op. supra cit.* Bd. ii. 61 and 69; and Bd. vi. 191.

² Pfaff, *op. supra cit.* vi. 191.

³ *Ibid.* 1790, part iv. p. 331.

⁴ *Lond. Med. and Phys. Journ.* 1793, part ii. p. 158.

⁵ *Med. Facts and Obs.* vii. 41.

⁶ Winterbottom; also Lettsom, *Mem. of the Med. Soc. of Lond.* iv. 191.

⁷ *Journ. de Chim. Méd.* ix. 389.

1. INFUSUM CUSPARIÆ, L. E.; *Infusion of Cusparia* [*Infusum Angusturæ*, U. S.].—(Cusparia, bruised, ʒv [ʒss, U. S.]; Boiling [distilled, L.] Water Oj. Macerate for two hours in a lightly covered vessel, and strain [through linen or calico, E.].—Tonic, stomachic, and stimulant. Used in low fever, bilious diarrhœas and dysenteries, muscular debility, dyspepsia, &c.—Dose, from fʒj to fʒij. Tincture of cinnamon is an agreeable addition to it.

2. TINCTURA CUSPARIÆ, E.; *Tincture of Cusparia*.—(Cusparia, in moderately fine powder, ʒivss; Proof Spirit Oij. This tincture is to be made like the tincture of cinchona, and most expeditiously by the process of percolation, E.)—Tonic, stimulant, and stomachic. Generally employed as an adjunct to bitter infusions.—Dose, fʒj to fʒij.

OTHER MEDICINAL RUTACEÆ.

The root of *DICTAMNUS FRAXINELLA*, or *Bastard dittany*, was formerly employed in medicine, but of late years has fallen into almost total disuse. There are two varieties of this plant: *a. purpurea* with purple flowers; and *β. alba* with white flowers. It is a native of the South of Europe. The root contains *volatile oil, resin, bitter extractive*, and probably *gum*. It is an aromatic tonic, and is reputed to possess antispasmodic, diuretic, and emmenagogue properties. It was formerly employed in intermittents, epilepsy, hysteria, amenorrhœa, chlorosis, and worms. The dose of it is from ʒj to ʒj. Attention has been recently drawn to it by Dr. Aldis,¹ who states that it has been employed, during forty years, with great success, in the cure of epilepsy, by Baron A. Sloet von Oldruitenborgh and family.² I am acquainted with one patient (a young lady) who took it for six months without receiving any ultimate benefit from it.

ORDER LXX. ZYGOPHYLLACEÆ, Lindley.—THE BEAN CAPER TRIBE.

ZYGOPHYLLÆ, R. Brown.

CHARACTERS—*Sepals* 5, distinct, or scarcely coherent at the base. *Petals* 5, alternate with the sepals, inserted on the receptacle. *Stamens* 10, distinct, hypogynous, 5 opposite to the sepals, and 5 to the petals. *Ovary* distinct, 5 celled; *styles* 5, united into one, sometimes rather distinct at the apex. *Capsule* of five carpels, which are more or less adnate to each other, and to the central axis; cells deliscent at the superior angle, usually many seeded, or 1-seeded, neither cocculiferous nor arilliferous. *Seeds* albuminous, or commonly exalbuminous; *embryo* straight; *radicle* superior; *cotyledons* foliaceous.—*Herbs, shrubs, or trees.* *Leaves* with stipules at the base, usually compound. (De Cand.)

PROPERTIES.—The Guaiacums are resinous, and possess stimulant properties.

297. GUAIACUM OFFICINALE, Linn. L. E. D.—OFFICINAL GUAIACUM.

Sex. Syst. Decandria, Monogynia.

(Lignum; Resina e ligno igne comparata, L.—Resin obtained by heat from the wood, E.—Wood and resin, D.)

[Guaiaci Lignum, Guaiaci Resina, U. S.]

HISTORY.—The Spaniards derived their knowledge of the medicinal uses of Guaiacum from the natives of St. Domingo, and introduced this remedy into Europe in the early part of the sixteenth century (about 1508). The first importer of it was Gonsalvo Ferrand, who, being infected with the venereal disease, and not obtaining any cure for it in Europe, went to the West Indies, to ascertain how the natives in that part of the world treated themselves, as the disease was as common with them as smallpox with Europeans. Having ascertained that Guaiacum was

¹ *Lond. Med. Gaz.* xix. 142.

² See *Lond. Med. and Phys. Journ.* xlv. 605.

employed, he returned to Spain, and commenced practitioner himself. "I suppose," says Freind,¹ "he might make a monopoly of it; for it appears that some time after, it was sold for seven gold crowns a pound."

BOTANY. Gen. Char.—*Calyc* 5-partite, obtuse. *Petals* 5. *Stamens* 10; *filaments* naked, or somewhat appendiculate. *Style* and *stigma* 1. *Capsule* somewhat stalked, 5-celled, 5-angled, or by abortion 2- or 3-celled. *Seeds* solitary in the cells, affixed to the axis, pendulous; *albumen* cartilaginous, with small chinks; *cotyledons* somewhat thick.—*Trees* with a hard wood. *Leaves* abruptly pinnate. *Peduncles* axillary, 1-flowered. (De Cand.)

Sp. Char.—*Leaves* bijugate; *leaflets* obovate or oval, obtuse. (De Cand.)

A *tree* rising 30 or 40 feet high. *Stem* commonly crooked; bark furrowed; wood very hard and heavy. *Leaves* evergreen. *Flowers* 6 to 10 in the axillæ of the upper leaves. *Peduncles* an inch and a half long, unifloral. *Sepals* 5, oval. *Petals* 5, oblong or somewhat wedge-shaped, pale-blue. *Stamens* somewhat shorter than the petals. *Ovary* compressed, 2-celled; *style* short, pointed. *Capsule* obovate, coriaceous, yellow.

Hab.—St. Domingo and Jamaica.

DESCRIPTION AND COMPOSITION.—In this country, the *wood* and the *resin* only are officinal; but on the continent, the *bark* also is used. They are imported from St. Domingo.

1. **Guaiacum Wood** (*Lignum Guaiaci*). This is commonly termed *lignum vitæ*.—It is imported in large logs or billets, and is extensively used for making pestles, rulers, skittle-balls, and various other articles of turnery ware. On examining the transverse sections of these stems, hardly any traces of medulla or pith are observable, while the annual or concentric layers or zones are extremely indistinct. The wood is remarkable, says Dr. Lindley,² "for the direction of its fibres, each layer of which crosses the preceding diagonally; a circumstance first pointed out to me by Professor Voigt." This fact, however, was noticed by Brown³ above fifty years ago. The distinction between the young and old wood is remarkable. The young wood (called *alburnum* or *sapwood*) is of a pale-yellow colour; while the old wood (called *duramen* or *heartwood*), which forms the central and principal part of the stem, is of a greenish-brown colour, in consequence of the deposition of resinous matter, first in the ducts and subsequently in all parts of the tissue. By boiling a thin shaving of the wood in nitric acid, the whole of the deposited matter is destroyed, and the tissue restored to its original colourless character.

Shavings, turnings, or raspings of guaiacum (*lignum guaiaci raspatum seu rasum; rasura vel scobs guaiaci*) are prepared by turners for the use of druggists and apothecaries. They are distinguished from the raspings of other woods by nitric acid, which communicates to them a temporary bluish-green colour. A decoction of the shavings is yellowish, and does not change colour in the air, and very little even by nitric acid, though after some time it becomes turbid. Neither a solution of emetic tartar, nor the tincture of nutgalls, causes any precipitate. The ferruginous salts deepen its colour.

Trommsdorff⁴ analyzed the wood, and found it to consist of *resin* 26.0, *bitter, piquant extractive* 0.8, *mucous extractive with a vegetable salt of lime* 2.8, *colouring matter* (?) similar to that of the bark 1.0, and *woody fibre* 69.4.

GUAIACUM BARK (*Cortex Guaiaci*) is gray, compact, very hard, heavy, and resinous. Its internal surface sometimes presents numerous small, brilliant, apparently crystalline points, which Guibourt supposes to be benzoic acid. Trommsdorff⁵ analyzed this bark, and found it to consist of the following substances: *peculiar resin*, different from that of the wood, 2.2, *peculiar, bitter, piquant extractive*, precipitable by acid, 48, *gum* 0.8, *brownish-yellow colouring matter* 4.1, *mucous extractive with sulphate of lime* 12.0, and *lignin* 76.0.

2. **Guaiacum Resin** (*Resina Guaiaci*).—This is commonly, though very erro-

¹ *Hist. of Physick*, 2d edit. part ii. p. 365.

² *Nat. Hist. of Jamaica*, p. 226.

³ *Ibid.* vii. 429.

⁴ *Nat. Syst. of Botany*, 2d edit. p. 134.

⁵ *Journ. de Chim. Méd.* vi. 430.

neously, denominated *gum guaiacum*. It is obtained from the stem of the tree by the following methods:—

a. *By natural exudation*.—It exudes naturally from the stem, and may be seen on it at all seasons of the year.¹ β. *By jagging*.—If the tree be wounded in different parts, a copious exudation takes place from the wounds, which hardens by exposure to the sun. This operation is performed in May.

γ. *By heat*.—Another method of obtaining it is the following: “The trunk and larger limbs being sawn into billets of about three feet long, an auger-hole is bored lengthwise in each, and one end of the billet so placed on a fire that a calabash may receive the melted resin which runs through the hole as the wood burns.”²

δ. *By boiling*.—It is also obtained in small quantities by boiling chips or sawings of the wood in water with common salt. The resin swims at the top, and may be skimmed off.³ The salt is used to raise the boiling point of the water.

Guaiacum occurs in tears and in masses. *Guaiacum in tears* (*Guaiacum in lachrymis*) occurs in rounded or oval tears, of varying size, some being larger than a walnut. Externally they are covered by a grayish dust. They are said to be produced by *Guaiacum sanctum*.⁴ *Lump Guaiacum* (*Guaiacum in massis*) is the ordinary kind met with in the shops. These masses are of considerable size, and are ordinarily mixed with pieces of bark, wood, and other impurities; they are of a brownish or greenish-brown colour, and have a brilliant, shiny, resinous fracture. Thin laminæ are nearly transparent, and have a yellowish-green colour. The odour is balsamic, but very slight, though becoming more sensible by pulverization. When chewed, guaiacum softens under the teeth, but has scarcely any taste, though it leaves a burning sensation in the throat. Its specific gravity is 1.2289. When heated, guaiacum melts and evolves a fragrant odour. The products of the destructive distillation of guaiacum have been examined both by Mr. Brande and Unverdorben. Among the new substances obtained by the latter, are *two empyreumatic oils of guaiacum* (one volatile, the other fixed) and *pyro-guaiacic acid*.

The characters of guaiacum resin, according to the *Edinburgh Pharmacopœia*, are as follows: “Fresh fracture red, slowly passing to green—the tincture slowly strikes a lively blue colour on the inner surface of a thin paring of a raw potato.”

In 1805, Mr. Brande⁵ analyzed guaiacum. In 1806, it was examined by Bucholz,⁶ and in 1828 by Buchner.⁷ Dr. Ure⁸ has made an ultimate analysis of it.

Brande's Analysis.		Buchner's Analysis.		Ure's Analysis.	
Substance <i>sui generis</i> (guaiacum properly so called)	91	Pure resin	79.8	Carbon	67.88
Extractive	9	Bark { Woody fibre.	16.5	Hydrogen	7.05
		20.1 { Tasteless gum	1.5	Oxygen	25.07
			2.1		
Guaiacum	100	Guaiacum	99.9	Guaiacum	100.00

1. **GUAIACIC ACID; *Guaiacin***.—Is insoluble in water, but is readily dissolved by alcohol, and is precipitated from its alcoholic solution by water, sulphuric and nitric acids, and chlorine. Ether dissolves the resin, but not so readily as alcohol. Solutions of the caustic alkalies (potash and soda) dissolve it, forming *alkaline guaiacates* (*guaiacum soaps*; *sapones guaiacini*). The mineral acids precipitate it from its alkaline solution. Various salts (as acetate of baryta, acetate of lime, acetate of lead, nitrate of silver, and chloride of gold) occasion precipitates (*guaiacates*) with the alkaline solution. Guaiacic acid is remarkable for the changes of colour it undergoes by the influence of various agents. Thus, its powder, and paper moistened with its tincture, become *green* in air or oxygen gas, but not in carbonic acid gas. This change, which seems connected with the absorption of oxygen, is influenced by the intensity and colour of the light. Various substances give a *blue* tint to guaiacum when in contact with air; thus gluten, but not starch. Hence powdered guaiacum has been proposed as a test for the goodness of wheaten flour (which contains gluten), and of the purity of starch. Gum Arabic, dissolved in cold water, has the same effect as gluten, but tragacanth gum has not. Milk, and various fresh roots and underground stems (for example those of the horseradish, potato, carrot, colchicum, &c.) also possess this property. Certain agents change the colour of guaiacum successively to *green*, *blue*, and *brown*; thus, nitric

¹ Brown, *op. supra cit.* p. 226.

² Wright, *op. supra cit.*

³ *Phil. Trans.* for 1806, p. 89.

⁴ Gmelin, *Handb. d. Chem.* ii. 571.

⁵ Wright, *Med. Plants of Jamaica*.

⁶ *Journ. de Pharm.* xx. 520.

⁷ Quoted by Schwartze, *Pharm. Tabell.* 2te Ausg. p. 293.

⁸ *Dict. of Chem.*

acid and chlorine. Nitric acid colours the tincture of guaiacum green, then blue, and afterwards brown. If a piece of paper moistened with the tincture be exposed to the fumes of the acid, its colour is immediately changed to blue. Spirit of nitric ether usually gives a blue colour to tincture of guaiacum. Mr. Brande has conjectured, and I think with great probability, that these different coloured compounds are combinations of oxygen with guaiacum—the green compound containing the least, the brown the most, while the blue is intermediate. Mr. Johnson¹ says guaiacum resin consists of $C^{40}H^{23}O^{10}$; its equivalent, therefore, is 343. According to Unverdorben, the resin of guaiacum is of two kinds; one readily soluble in a solution of ammonia—and another which forms with ammonia a tarry compound. Pagenstecher has shown that tincture of guaiacum with hydrocyanic acid and sulphate of copper produces an intense blue colour.

2. **EXTRACTIVE**.—This is extracted from guaiacum by the agency of water. The quantity obtained is liable to variation. It is a brown acrid substance.

These observations, then, show that guaiacum is essentially a *peculiar resin*, mechanically mixed with variable but small quantities of extractive and other impurities.

ADULTERATION.—Various adulterations are described as being practised on guaiacum. Though I have found this substance in the shops of this country of unequal degrees of impurity, I have never had reason to suspect that sophistication had been practised on it. The presence of turpentine resin might be detected by the peculiar odour evolved when the suspected resin is heated. Another mode of detecting this fraud is to add water to the alcoholic solution of the suspected guaiacum, and to the milky liquid thus formed, a solution of caustic potash is to be added until the liquor becomes clear. If now an excess of potash cause no precipitate, no resin is present; for while *guaiacate of potash* is soluble in water, the salt produced by the union of potash and resin is not completely so.

PHYSIOLOGICAL EFFECTS. 1. **Of the Resin.**—Guaiacum resin is an acrid stimulant. Its acridity depends in a great measure on the extractive with which the resin is mixed, or which resides in the fragments of bark contained in the resin.

Under the use of *small and repeated doses* of guaiacum, various constitutional diseases sometimes gradually subside, and a healthy condition of system is brought about with no other sensible effect of the remedy, than perhaps the production of some dyspeptic symptoms, and a slight tendency to increased secretion. We designate this inexplicable, though not less certain, influence over the system, by the term *alterative*. When we give guaiacum in *moderately large doses*, or to plethoric easily excited individuals, we observe the combined operation of an acrid and stimulant. The local symptoms are, the dryness of the mouth, the sensation of heat at the stomach, nausea, loss of appetite, and a relaxed condition of the bowels. The stimulant operation is observed partly in the vascular system, but principally in the exhaling and secreting organs, especially the skin and kidneys. Dr. Cullen justly observes that it seems to stimulate the exhalants more in proportion than it does the heart and great arteries. If diluents be exhibited, and the skin kept warm, guaiacum acts as a powerful sudorific; whereas, when the surface is kept cool, perspiration is checked, and diuresis promoted. By continued use, it has caused a mild salivation.² The stimulant influence of guaiacum is extended to the pelvic vessels, and thus the hemorrhoidal and menstrual discharges are somewhat promoted by it. But there is no reason for supposing that the pelvic organs are specifically affected by it. In *very large doses*, guaiacum causes heat and burning in the throat and stomach, vomiting, purging, pyrexia, and headache.

In its operation on the system, guaiacum is allied to the balsams. Dr. Cullen considered its resinous part to be very analogous to the balsams and turpentine.

2. **Of the Wood.**—The operation of the wood is similar to, though milder than, that of the resin. Any activity which the wood communicates to boiling water must depend on the extractive, as the resin is not soluble in this fluid.

Pearson³ says, that the decoction excites a sensation of warmth in the stomach, produces dryness of the mouth, with thirst, increases the natural temperature of the

¹ *Proceed. of the Royal Soc.* June 18, 1810.

² Burd'ch, *Syst. d. Arzneim.* Bd. ii. S. 253.

³ *Observ. on the Effects of Various Articles of the Mat. Med.* p. 8, Lond. 1800.

skin, renders the pulse more frequent, and, if the patient lie in bed and take the decoction warm, it proves moderately sudorific; but if he be exposed freely to the air, it acts as a diuretic. Continued use occasions heartburn, flatulence, and costiveness. Kraus¹ mentions a measles-like eruption over the whole body, as being produced by large doses of the wood.

3. *Of the Bark.*—The bark acts in a similar way to the wood. Regnandot² injected, at eight in the morning, three ounces of an aqueous infusion of it into the veins of a young man twenty years of age. In half an hour a shivering fit came on, with colicky pains, followed by two stools; this shivering remained till five o'clock in the evening.

USES.—In the employment of guaiacum, the acrid and stimulant properties of this resin are to be remembered. The first unfits it for use in cases of impaired digestion, where there is irritation or great susceptibility of, or inflammatory tendency in, the alimentary canal; the second renders it improper in plethoric individuals, in all states of excitement or acute inflammation, and in persons whose vascular system is easily excited, and who are disposed to hemorrhages. It is admissible and useful, on the other hand, in atonic or chronic forms of disease, with retained secretions, especially in relaxed and phlegmatic constitutions.

The following are some of the diseases in which it has been employed:—

1. *In chronic rheumatism*, especially when occurring in scrofulous subjects, or in persons affected with venereal disease, guaiacum may be administered with considerable advantage under the conditions before mentioned. In cases of great debility, with coldness of surface, and in old persons, the ammoniated tincture may be employed.

2. *In gout.*—As a preventive of gout it was introduced by Mr. Emerigon, of Martinico.³ His remedy (the *specificum antipodagricum Emerigonis*, as our German brethren term it) consisted of two ounces of guaiacum digested for eight days in three pints avoirdupois of rum. The dose was a tablespoonful, taken every morning, fasting, for a twelvemonth. Its stimulant qualities render it inadmissible during a paroxysm of gout; and with regard to its use in the interval, it is, of course, adapted for chronic atonic conditions only.

3. *In chronic skin diseases*, where sudorifics and stimulants are indicated, guaiacum may be serviceable, especially in scrofulous and syphilitic subjects.

4. *In obstructed and painful menstruation*, not arising from any plethoric, inflammatory, or congested state of system, the volatile tincture of guaiacum has been employed with advantage. Dr. Dewees⁴ states that he has long been in the habit of employing it in painful menstruation with good effect. Drs. Macleod and Jewell have also borne testimony to its emmenagogue qualities.

5. *As a remedy for venereal diseases*, guaiacum wood was at one time in the greatest repute. Nicholas Poll⁵ tells us that, within nine years from the time of its introduction into Europe, more than three thousand persons had derived permanent benefit from its use. Experience, however, has taught us the true value of this remedy, and we now know that it has no specific powers of curing or alleviating syphilis. It is applicable, as an alterative and sudorific, for the relief of secondary symptoms, especially venereal rheumatism and cutaneous eruptions, more particularly of scrofulous subjects. Mr. Pearson found it serviceable after the patient had been subjected to a mercurial course. Under its use, thickening of the ligaments and periosteum subsided, and foul, indolent sores healed. During its administration, the patient should adhere to a sudorific regimen.

6. *In scrofula*, especially that form called cutaneous, guaiacum is used with occasional advantage.

7. *In chronic pulmonary catarrh*, especially of gouty subjects, it has also been used.

¹ *Heilmittellehre*, 612.

² *Journ. de Méd.* xlvii. 424

³ Quoted by Pearson, *op. supra cit.*

⁴ Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. ii. S. 411.

⁵ *Treatise on the Diseases of Females*, 2d edit. p. 81, 1828.

ADMINISTRATION.—The *powder* of guaiacum resin may be given in doses of from grs. x to ʒss. It may be administered in the form of pill, bolus, or mixture (see *Mistura Guaiaci*). The resin is a constituent of the *Pilulæ hydrargyri chloridi compositæ*, Ph. L., commonly termed *Plummer's Pills*, and of the *Pulvis aloës compositus*. The resin is also given in the form of *alcoholic* and *ammoniated tincture*. The wood is exhibited in *decoction* only. It is a constituent of the *Decoctum sarzæ compositum*, L.

1. **MISTURA GUAIACI**, L. E.; *Guaiacum Mixture*.—(Guaiacum ʒiij; Sugar ʒss; Acacia Powder ʒij; Cinnamon Water Oj [fʒixss, E.]. Rub the guaiacum with the sugar and acacia, and to these, while rubbing, add gradually the cinnamon water.)—Dose, fʒss to fʒij twice or thrice a-day.

2. **TINCTURA GUAIACI**, E. D. (U. S.); *Tincture of Guaiacum*.—(Guaiacum, in coarse powder, ʒvij [ʒviiij, D.] [℥ss, U. S.]; Rectified Spirit Oij. Digest for seven days, E. [fourteen days, D.] [U. S.], and then filter [strain, express and filter, D.].)—Stimulant, sudorific, and laxative. Dose, fʒj to fʒiv. As it is decomposed by water, it should be administered in mucilage, sweetened with water or milk, to hold the precipitated resin in suspension.

3. **TINCTURA GUAIACI COMPOSITA**, L.; *Compound Tincture of Guaiacum*; *Tinctura Guaiaci Ammoniata*, E. [U. S.]; *Volatile Tincture of Guaiacum*.—(Guaiacum, in coarse powder, ʒvij, ʒiv; Aromatic Spirit of Ammonia Oij [Oiss, U. S.] [Spirit of Ammonia Oij, E.]. Digest for seven days [in a well-closed vessel, E.], and then filter.)—A powerfully stimulating sudorific and emmenagogue.—Dose, fʒss to fʒij. May be taken as the preceding.

4. **DECOCTUM GUAIACI**, E.; *Decoction of Guaiacum*.—(Guaiacum turnings ʒiij; Raisins ʒij; Sassafras, rasped, ʒj; Liquorice Root, bruised, ʒj; Water Oviiij. Boil the guaiacum and raisins with the water gently down to Ov, adding the liquorice and sassafras towards the end. Strain the decoction.)—This is the old *Decoction of the Woods*. The resin of guaiacum being insoluble in water, the extractive alone is dissolved by this menstruum. The sassafras can confer but little activity on the preparation. Taken in doses of fʒiv, four times daily, and continued with a sudorific regimen, it acts on the skin, and has been thought to be useful as an alterative in old venereal, rheumatic, and cutaneous diseases.

ORDER LXXI. OXALIDACEÆ, Lindley.—THE WOOD-SORREL TRIBE.

OXALIDÆ, De Candolle.

CHARACTERS.—*Sepals* 5, sometimes slightly cohering at the base, persistent, equal. *Petals* 5, hypogynous, equal, unguiculate, with a spirally-twisted æstivation. *Stamens* 10, usually more or less monadelphous, those opposite the petals forming an inner series, and longer than the others; *anthers* 2-celled, innate. *Ovary* with 5 angles and 5 cells; 5 *styles* filiform; *stigmas* capitate or somewhat bifid. *Fruit* capsular, membranous, with 5 cells, and from 5 to 10 valves. *Seeds* few, fixed to the axis, inclosed within a fleshy integument, which curls back at the maturity of the fruit, and expels the seeds with elasticity. *Albumen* between cartilaginous and fleshy. *Embryo* the length of the albumen, with a long radicle pointing to the hilum, and foliaceous cotyledons.—*Herbaceous plants, under-shrubs, or trees. Leaves* alternate, compound, sometimes simple by abortion, very seldom opposite or somewhat whorled (Lindley).

PROPERTIES.—Acidulous and refrigerant.

298. *OXALIS ACETOSELLA*, Linn.—COMMON WOOD-SORREL.

Ses. Syst. Decandria, Pentagynia.

HISTORY.—Mr. Bicheno¹ declares this to be the genuine shamrock.BOTANY. **Gen. Char.**—*Sepals* 5, free or united at the base. *Petals* 5; *Stamens* 10; *filaments* slightly monadelphous at the base, the five external alternate ones shorter. *Styles* 5, pencilled at the apex or capitate. *Capsule* pentagonal, oblong, or cylindrical. (De Cand.)—Perennial herbs. *Leaves* never abruptly pinnate.**Sp. Char.**—*Leaves* all radical, ternate; *leaflets* inversely heart-shaped, hairy. *Scape* single-flowered. *Root* [rhizome] scaly (Hooker).An elegant little plant. *Leaflets* delicate bright green, often purplish at the back, drooping at night. *Footstalks* slender, purplish. *Bracts* 2, scaly. *Flowers* drooping, white, with purplish veins.**Hab.**—Indigenous; woody and shady places. Flowers in May.**DESCRIPTION.**—Woodsorrel (*herba acetosellæ*) is odourless. Its taste is agreeably acidulous.**COMPOSITION.**—I am unacquainted with any analysis of this plant. Its expressed juice yields by evaporation *binoxalate of potash*. Payen² analyzed *Oxalis crenata*. From its stems he obtained *water*, *lignin*, *oxalate of potash*, *albumen*, *soluble nitrogenous matter*, *chlorophylle*, *oxalate of ammonia*, *free oxalic acid*, *oxides*, *salts*, *gum*, *an aromatic substance*, and *sugar*. The quantity of oxalate of potash was from 1.06 to 1.23 per cent.**BINOXALATE OF POTASH; Salt of Woodsorrel.**—In Switzerland and some parts of Germany, this salt is obtained on the large scale from woodsorrel, by evaporating the expressed juice, redissolving the residue, and crystallizing. 500 parts of the plant yield four parts of the crystallized salt. It crystallizes in white rhombic prisms. It consists of—

	Atoms.	Eq. Wt.
Oxalic acid	2	72
Potash	1	48
Water	2	18
Crystallized binoxalate potash	1	138

In commerce the quadroxalate of potash is substituted for it (see p. 512).

PHYSIOLOGICAL EFFECTS AND USES.—Woodsorrel is refrigerant. Taken as a salad, it is considered a good antiscorbutic. Infused in milk, to form whey, or in water, it furnishes a grateful drink in fevers. A solution of the binoxalate of potash has been employed as a substitute for lemonade.

ORDER LXXII. VITACEÆ, Lindley.—THE VINE TRIBE.

AMPELIDEÆ, Kunth, De Candolle.

CHARACTERS.—*Calyx* small, nearly entire at the edge. *Petals* 4 or 5, inserted on the outside of the disk surrounding the ovary; in æstivation turned inwards at the edge, in a valvate manner, and often inflexed at the point. *Stamens* equal in number to the petals, and opposite them, inserted upon the disk, sometimes sterile by abortion; *filaments* distinct, or slightly cohering at the base; *anthers* ovate, versatile. *Ovary* superior, 2-celled; *style* 1, very short; *stigma* simple; *ovules* erect, definite. *Berry* round, often by abortion 1-celled, pulpy. *Seeds* 4 or 5, or fewer by abortion, bony, erect; *albumen* hard; *embryo* erect, about one-half the length of the albumen; *radicle* taper; *cotyledons* lanceolate, plano-convex.—Scrambling, climbing *shrubs*, with tumid separable joints. *Leaves* with stipules at the base, the lower opposite, the upper alternate, simple or compound. *Peduncles* racemose, sometimes by abortion changing to tendrils often opposite the leaves. *Flowers* small, green (Lindley).**PROPERTIES.**—Acid leaves, and a fruit like that of the common grape, is the usual character of the order (Lindley).¹ Phil. Mag. new series, vii. 288.² Journ. de Chim. Méd. new series, i. 260.

299. *VITIS VINIFERA*, Linn. L. E. D.—COMMON GRAPE-VINE.

Sex. Syst. Pentandria, Monogynia.

(Fructus præparatus, L.—Dried fruit, E.—The fresh and the dried fruit, D.)

HISTORY.—The grape-vine has been known and cultivated from the most remote periods of antiquity. Among the most ancient of the profane writers, Homer,¹ Hippocrates, and Herodotus,² may be referred to as speaking of the vine.

Fig. 389.

*Vitis vinifera*.

BOTANY. **Gen. Char.**—*Calyx* somewhat 5-toothed. *Petals* 5, cohering at the point, separating at the base, and dropping off like a calyptra. *Stamens* 5. *Style* 0. *Berry* 2-celled, 4-seeded; the cells or seeds often abortive. (De Cand.)

Sp. Char.—*Leaves* lobed, sinuated, toothed, smooth or downy. (De Cand.)

A hardy, exceedingly variable shrub. *Leaves* more or less lobed, smooth, pubescent or downy, flat or crisp, pale or intensely green. [*Tendrils* opposite to each footstalk, solitary, spiral.] *Branches* prostrate, climbing or erect, tender or hard. *Racemes* loose or compact, ovate or cylindrical. *Fruit* red, pale, or white, watery or fleshy, globose, ovate or oblong, sweet, musky, or austere. *Seeds* variable in number, or sometimes the whole of them abortive. (De Cand.)—No less than 1,400 varieties are cultivated at the Luxembourg gardens.

DESCRIPTION.—Grapes (*Uvæ*) considered with respect to their shape and colour, may be thus arranged:³—

1. *Round, dark-red, purple, or black grapes.*—The most remarkable variety of this division is the *black Corinthian grape*, which, when dried, constitutes the *currant* of the grocer.

2. *Oval, dark-red, purple, or black grapes.*—To this division belongs the favourite *black Hamburg grape*.

3. *Round and white grapes.*

4. *Oval and white grapes.*—The *Portugal grape* comes under this division. It is imported, packed in saw-dust, and contained in earthen jars, from Portugal and Spain. The berries are large, fleshy, sweet, and slightly acidulous. They keep a long time after they have ripened. In 1822, the *ad valorem* duty of 20 per cent. on these grapes produced £1720.⁴ The *white Corinthian grape* is remarkable for its elongated elliptical berry.

5. *Red, rose-coloured, grayish, or striped grapes.*

Various parts of the vine, some of which were formerly employed in medicine, are distinguished by peculiar names; thus, the leaves are termed *pampini*; the cirrhi or tendrils, *capreoli*; the tender shoots, *palmites*; the juice or sap, *lachryma*; and the juice of unripe grapes *omphacium*, or commonly *agresta*.⁵ The twigs or cuttings of the vine are used for flavouring vinegar.

COMPOSITION.—The juice of unripe and ripe grapes has been examined by several chemists. The following are the most important results:⁶—

¹ *Od.* vii. 121; and xxiv. 342.

² Thompson, in London's *Encycl. of Gardening*.

³ Murray, *App. Med.* i. 441.

⁴ *Euterpe*, lxxvii.

⁵ McCulloch, *Dict. of Commerce*.

⁶ Gmelin, *Handb. d. Chem.* ii. 1255.

Juice of the Unripe Grape.		Juice of the Ripe Grape.	
Proust.	Geiger.	Proust.	Bérard.
Extractive. Malic acid, a little. Citric acid, much. Bitartrate of potash. Sulphate of potash. Sulphate of lime.	1. Deposit from the juice. <div> <div>Wax.</div> <div>Chlorophylle.</div> <div>Tannin.</div> <div>Glutinous matter.</div> <div>Tannin.</div> <div>Extractive.</div> <div>Sugar (unecrystallizable).</div> <div>Gallie acid.</div> <div>Tartaric acid (free) about 1.12 per cent.</div> <div>Malic acid (free) about 2.19 per cent.</div> <div>Bitartrate of potash.</div> <div>Malate, phosphate, sulphate, and muriate of lime.</div> </div>	Extractive. Sugar (granular and unecrystallizable). Gum. Glutinous matter. Malic acid, a little. Citric acid, a little (tartaric, <i>Braconot</i>). Bitartrate of potash.	Odorous matter. Sugar. Gum. Glutinous matter. Malic acid. Malate of lime. Bitartrate of potash. Supertartrate of lime.
Unripe Grape juice.	2. Filtered juice.	Ripe Grape juice.	Ripe Grape juice.
Juice of White Grape of good quality.			

1. **GRAPE SUGAR.**—This is one variety of the *granular* or *crumbling* sugars (*Krümelsuckers*) of the Germans. It agrees with common sugar in its essential properties (see p. 180), but is less soluble in water and in alcohol than the latter, and does not sweeten so effectually. From its boiling alcoholic solution it is deposited, on cooling, in the form of an irregularly crystalline mass. Its formula is $C_{12}H_{14}O_{14}$.

2. **BITARTRATE OF POTASH.**—The impure bitartrate of potash, called *crude tartar* or *argol*, which is deposited during the fermentation of grape wine, and the purified bitartrate, have been already described.—(See vol. i. page 508).

DRIED GRAPES OR RAISINS.—Grapes, when properly dried, are denominated *Raisins* (*Uvæ passæ*). Of these there are two principal kinds:—

1. **RAISINS COMMONLY SO CALLED** (*Uvæ passæ majores*; *Passulæ majores*). In Granada, the finest kinds of raisins (viz. the *Muscatsels* and the *Blooms*) are sun-dried; while the *Lexias* (so called from the liquor in which they are immersed) are dipped in a mixture of water, ashes, and oil, and afterwards sun-dried.¹ By this treatment, the juice exudes and candies on the fruit. Dillon² states that the sun-dried raisins have their stalk half cut through while the bunch remains on the vine. The raisins of Valentia are prepared by steeping them in boiling water, to which a lye of vine stems has been added.³ Some raisins are said to be dried by the heat of an oven. Raisins are imported in casks, barrels, boxes, and jars. The best come in jars and quarter boxes weighing twenty-five lbs. The varieties known in the market are distinguished partly from their place of growth, as *Valentias* and *Smyrnuis*; partly from the variety of grape from which they are prepared, as *Sultanus*, *Blooms*, and *Muscatsels*; and partly from the mode of curing them, as *Raisins of the Sun*. Muscatsels are the finest. Sultanus are stoneless. The raisins of Malaga are of three kinds:⁴ 1st, *Muscatsels*; 2d, *Sun* or *Bloom Raisins* (obtained from a long grape called *Uva larga*); and the *Lexia Raisins*.

2. **CORINTHIAN RAISINS OR CURRANTS** (*Uvæ passulæ minores*; *Passulæ minores*; *Passulæ Corinthiæ*). These are obtained from a remarkably small variety of grape called the *Black Corinth*. They were formerly produced at Corinth (whence they received their name), but are now grown in Zante, Cephalonia, Patras, &c. At Zante, they are gathered in August, disposed in couches on the ground to dry, cleaned and laid up in magazines (called *seraglios*), where they eventually adhere so firmly as to require digging out.⁵ They require eight, ten, or fourteen days for drying.⁶ For exportation they are trodden in barrels.

PHYSIOLOGICAL EFFECTS.—*Fresh grapes*, when ripe, are wholesome, nutritious, refrigerant, and, when taken freely, diuretic and laxative. The skin and the seeds are indigestible, and should be rejected. "I think we may assert," says Dr. Cullen,⁷ "that grapes which contain a large quantity of sugar are, if taken without their husks, the safest and most nutritive of summer fruits." *Raisins* are somewhat more nutritive and less refrigerant; for they abound more in sugar, and contain less acid than the fresh grape; but, if eaten too freely, they are apt to disorder the digestive organs, and cause flatulence. They possess demulcent and emollient qualities.

USES.—Both grapes and raisins are employed at the table as a dessert. They

¹ Inglis, *Spain* in 1830, ii. 193.

² Laborde, *A View of Spain*, iv. 99.

³ Busby's *Journal of a recent Visit to the principal Vineyards of Spain and France*, p. 44, Lond. 1834.

⁴ Spon and Wheler, *Voyage d'Italie*, &c. t. i. p. 85—87.

⁵ Holland, *Travels in the Ionian Isles*, p. 21; and Williams, *Travels in Italy*, &c. ii. 182.

⁷ *Mat. Med.* i. 253.

² *Travels through Spain*, p. 376.

are apt to disagree with dyspeptics and children. Raisins are also used in various articles of pastry. Considered medicinally, *fresh grapes* prove valuable in febrile and inflammatory complaints; they allay thirst and diminish febrile heat; they have been found serviceable in dysentery¹ and in phthisical complaints.² "The subjects of pulmonary affections, who pass the summer in Switzerland," observes Sir J. Clark,³ "may try the effects of a course of grapes, 'cure de raisins,' a remedy in high estimation in several parts of the continent.

Raisins are employed in medicine principally as flavouring agents; they enter into several official preparations (as *Decoctum Hordei compositum*, *Decoctum Guaiaci*, *Tinctura Cardamomi composita*, *Tinctura Sennæ composita*, *Tinctura Quassæ composita*), the flavour of which they improve, though they contribute nothing to the efficacy of these compounds.

1. POTASSÆ BITARTRAS.—See page 508.

2. ACIDUM TARTARICUM.

3. TROCHISCI ACIDI TARTARICI, E.; *Acidulated Lemon Lozenges*, or *Acidulated Drops*.—(Tartaric Acid ʒij; Pure Sugar ʒviij; Volatile Oil Lemons m. x. Pulverize the sugar and acid, add the oil, mix them thoroughly, and with mucilage beat them into a proper mass for making lozenges.)—Employed for coughs and sore-throats. More commonly taken, on account of their agreeable flavour, as articles of confectionery.

4. VINUM; *Wine*.—The necessarily confined limits of this work compel me to devote a smaller space to the consideration of wine than its interest and importance otherwise demand.

In the British pharmacopœias, the only official wine directed to be used is *Sherry* (*Vinum Xericum*, L.; *Vinum Album*; *Sherry*, E.; *Vinum album Hispanicum*, D.). For medicinal purposes, however, other wines are also used; so that it is necessary to take a general view of the properties of wines.

The *manufacture* of wine deserves a passing notice. Grape juice does not ferment in the grape itself. This is owing, not, as Fabroni⁴ supposed, to the gluten being contained in distinct cells to those in which the saccharine juice is lodged, but to the exclusion of atmospheric oxygen, the contact of which, Gay-Lussac⁵ has shown, is necessary to effect some change in the gluten, whereby it is enabled to set up the process of fermentation. The expressed juice of the grape, called *must* (*mustum*), whose composition has been already stated, readily undergoes the vinous fermentation when subjected to a temperature of between 60° and 80° F. It becomes thick, muddy, and warm, and evolves carbonic acid gas. After a few days this process ceases; the thick part subsides, the liquid becomes clear, and is then found to have lost its sweet taste, and to have become vinous. I have already explained the theory of the process, and also made some remarks respecting yeast. The wine is now drawn off into casks, where it undergoes farther changes. It is then racked off into other casks, where it is subjected to the operation of *sulphuring* (*i. e.* exposed to sulphurous acid, either by burning sulphur matches in the cask, or by the addition of wine impregnated with this acid), to render the glutinous matter incapable of re-exciting fermentation. After this, the wine is usually clarified, or *fined* (*i. e.* deprived of those matters which render the wine turbid, and dispose it to undergo deteriorating changes). Isinglass or white of egg (*i. e.* gelatine or albumen) is commonly employed for this purpose. The first forms with the tannic acid—the second with the alcohol, reticulated coagula, which envelop and carry down the solid particles that endanger the safety of the wine.⁶

¹ Zimmerman, *Treat. on Dysent.* 2d edit. p. 87, Lond. 1774.

² Moore, *View of Society, &c. in Italy*, ii. 254.

³ *The Sanative Influence of Climate*, 3d edit. p. 256, 1841.

⁴ *Ann. de Chim.* lxxvi. 245.

⁵ *De l'Art de faire le Vin*. Paris, 1801.

⁶ For further details, consult Fabroni, *De l'Art de faire le Vin*, traduit de l'Italien par F. R. Baud, Paris, 1801; Chaptal, *L'Art de faire le Vin*, 2e edit. Paris, 1819; also *Ann. de Chim.* t. xxxv. xxxvi. xxxvii.; Dr. Macculloch, *Remarks on the Art of Making Wine*, 1816; and Busby's *Journal*, before quoted.

The peculiar qualities of the different kinds of wine depend on several circumstances; such as the variety and place of growth of the vine from which the wine is prepared, the time of year when the vintage is collected, the preparation of the grapes previously to their being trodden and pressed, and the various manipulations and processes adopted in their fermentation.

The wines of different countries are distinguished in commerce by various names. The following is a list of the wines most commonly met with, arranged according to the countries producing them:—

1. FRENCH WINES.—*Champagne* (of which we have the *still*, *creaming*, or *slightly sparkling*, the *full frothing*, the *white*, and the *pink*); *Burgundy* (red and white); *Hermitage*; *Côte Rôtie*; *Rousillon*; *Frontignac*; *Claret* (the most esteemed being the produce of *Lafitte*, *Latour*, *Château Margaux*, and *Haut-Brion*); *Vin de Grave*; *Sauterne*; and *Barsac*.

2. SPANISH WINES.—*Sherry* (Xeres); *Tent* (Rota); *Mountain* (Malaga); *Benicarlo* (Alicant).

3. PORTUGAL WINES.—*Port*, red and white (Oporto); *Bucellas*, *Lisbon*, *Calcavella*, and *Colares* (Lisbon). An inferior description of red Port Wine is shipped at *Figuera* and *Aveiro*.

4. GERMAN WINES.—*Rhine and Moselle Wines*. The term *Hock* (a corruption of *Hochheimer*) is usually applied to the first growths of the Rhine. The term *Rhenish* commonly indicates an inferior Rhine wine.

5. HUNGARIAN WINES.—*Tokay*.

6. ITALIAN AND SICILIAN WINES.—*Lachryma Christi*; *Marsala*; *Syracuse*; *Lissa*.

7. GRECIAN AND IONIAN WINES.—*Candian* and *Cyprus* wines.

8. WINES OF MADEIRA AND THE CANARY ISLANDS.—*Madeira* and *Canary* (Teneriffe).

9. WINES OF THE CAPE OF GOOD HOPE.—*Cape Madeira*, *Pontac*, *Constantia* red and white (a sweet, luscious wine, much esteemed).

10. PERSIAN WINES.—*Shiraz*.

11. ENGLISH WINES.—*Grape*, *Raisin*, *Currant*, *Gooseberry*, &c.

Wines are also designated, according to their colour, *red* or *white*; according to their taste and other properties, *sweet*, *acidulous*, *dry*, *strong* or *generous*, *light*, *rough*, *sparkling*, &c.

The constituents of wine are, according to Gmelin, as follows: *Alcohol*, an *odorous principle* (volatile oil?) *blue colouring of the husk* (in red wine), *tannin*, *bitter extractive*, *grape sugar* (especially in the sweet wines), *gum*, *yeast*, *acetic acid* (from the commencement of the acetous fermentation), *malic acid*, *tartaric acid*, *bitartrate of potash*, *bitartrate of lime*, *sulphates* and *chlorides*, *phosphate of lime*, *carbonic acid* (especially in the effervescing wines), and *water*. To these may be added, in some of the Rhine wines, *paratartaric* or *racemic acid*.

1. BOUQUET OF WINE: *Odoriferous Principle of Wine*.—Every wine has a peculiar odour, which depends, doubtless, on a small quantity of volatile oil. The oil obtained from corn and potato spirit has been already noticed. Liebig and Pelouze² have examined the oily liquid procured in the distillation of wine as well as by submitting wine lees to distillation, and found it to be *ananthic ether* (C¹⁸O¹⁸O³) mixed with *ananthic acid* (C¹⁴H¹²O²). From 22,000 lbs. (about 2200 imperial gallons) only two lbs. and one fifth of oily liquid were procured.

2. ALCOHOL.—Mr. Brande³ has shown that alcohol exists ready formed in wine. He also ascertained the quantity of this substance which exists in different wines. The latter point has also been examined by several other chemists; as Geiger,⁴ Julia-Fontenelle,⁵ Prout, and Ziz,⁶ and more recently by Dr. Christison.⁷ Buris⁸ has ascertained the alcoholic strength of the wines of the Pyrénées-Orientales. Wines which contain a comparatively small quantity of spirit are denominated *light wines*; while those which have a much larger quantity are denominated *strong* or *generous wines*.⁹

¹ *Handb. d. Chem.* ii. 1255.

² *Phil. Trans.* for 1811, p. 337; and for 1813, p. 82.

³ *Journ. de Chim. Méd.* iii. 332.

⁴ *Jameson's Journal*.

⁵ For further details respecting wines, the reader is referred to the works of Barry and Henderson, already quoted, and to *The Topography of all the known Vineyards*, English translation, 1824; *Reed n^es History of Modern Wines*, 1833; and *Busby's Visit to the Vineyards of Spain and France*, London, 1834.

⁶ *Ann. de Chim. et de Phys.* lxii. 438.

⁷ Gmelin, *Handb. d. Chem.* ii. 1256.

⁸ Henderson, *op. cit.* p. 363.

⁹ *Journ. de Chim. Méd.* 2e sér. t. v. p. 502.

Table of the proportion of Alcohol (sp. gr. 0.825 at 60° F.) by measure, contained in 100 parts of Wine.
(A. means average; F. Fontenelle; P. Prout.)

	Brande.	Others.		Brande.	Others.
1. Lissa	A. 25.41	15.90 P.	24. White Hermitage	17.43	
2. Raisin	A. 25.12		25. Roussillon	A. 18.13	
3. Marsala	A. 25.09		26. Claret	A. 15.10	
4. Port	A. 22.96	18.40 P.	27. Zante	17.05	
5. Madeira	A. 22.27	20.64 P.	28. Malmsey-Maderia	16.40	
6. Currant	20.55	21.20 P.	29. Lunel	15.52	18.01 F.
7. Sherry	A. 19.17		30. Sheraaz	15.52	
8. Teneriffe	19.79	23.80 P.	31. Syracuse	15.28	30.00 P.
9. Colares	19.75		32. Sauterne	14.22	
10. Lachryma Christi	19.70		33. Burgundy	A. 14.57	12.16 P.
11. Constantia, white	19.75	14.50 P.	34. Hock	A. 12.08	
12. Constantia, red	18.92		35. Nice	11.63	
13. Lisbon	16.91		36. Barsac	13.86	
14. Malaga	18.94		37. Tent	13.30	12.20 F.
15. Bucellas	18.49		38. Champagne	A. 12.61	
16. Red Madeira	A. 20.35		39. Red Hermitage	12.32	
17. Cape Muschat	18.25		40. Vin de Grave	13.94	
18. Cape Madeira	A. 20.51		41. Frontignol (Rivesalte)	12.79	
19. Grape Wine	15.11		42. Côte Rôtie	12.32	
20. Calcevella	A. 18.65		43. Gooseberry	11.84	
21. Vidonia	19.25		44. Orange	A. 11.26	
22. Alba Flore	17.26		45. Tokay	9.88	
23. Malaga	17.26		46. Elder	8.79	

According to the more recent experiments of Dr. Christison, the quantity of alcohol in wines has been somewhat overrated. The following are his results:—

	Alcohol (0.7999) per cent. by weight.	Proof Spirit per cent. by volume.
Port {	Weakest	14.97
	Mean of 7 wines	16.20
	Strongest	17.10
	White	14.97
Sherry {	Weakest	13.98
	Mean of 13 wines, excluding those very long kept in cask	15.37
	Strongest	16.17
	Mean of 9 wines very long kept in cask in the East Indies	14.72
Madeira—All long in cask in East Indies {	Madre da Xeres	16.90
	Strongest	16.90
Teneriffe, long in cask at Calcutta {	Weakest	14.09
	Strongest	13.84
Cereial	15.45	33.65
Dry Lisbon	16.14	34.71
Shiraz	12.95	25.30
Amontillado	12.63	27.60
Claret, a first growth of 1811	7.72	16.95
Chateau-Latour, first growth 1825	7.78	17.06
Rosan, second growth 1825	7.61	16.74
Ordinary Claret, a superior "vin ordinaire"	8.99	18.96
Rivesaltes	9.31	22.35
Malmsey	12.86	28.37
Rüdesheimer, superior quality	8.40	18.44
Ditto inferior quality	6.90	15.19
Hambacher, superior quality	7.35	16.15

Dr. Christison states that by keeping wines, as Sherry and Madeira, in casks, for a moderate term of years, the quantity of alcohol increases; but after a certain time it decreases; and it is probable that at the period when wines begin to lose alcohol, they cease to improve in flavour.

3. **FREE ACIDS**.—All wines are more or less acidulous, as determined by litmus. They owe this property principally to malic acid, but in part also to citric and tartaric acids. The Rhenish and Moselle wines and claret are termed *acid wines*. The brisk, frothing, sparkling, or *effervescent wines* (as Champagne), which are bottled before fermentation is complete, owe their peculiar properties to the retention, and subsequent escape when the confining force is removed, of the developed carbonic acid gas. They are apt to become *ropy*, a change which is prevented by pure tannic acid or powdered nutgalls. The tannic acid of some wines, especially the red wines (as Port), is derived, in great part, from the husk of the grape, but partly, perhaps, from the seeds. It gives to these wines their astringency, and power of becoming dark-coloured with the ferruginous salts.

4. **SUGAR**.—This constituent varies considerably in quantity in different wines. Those in which it is abundant are denominated *sweet wines*, as Tokay, Tent, and Frontignac.

5. **EXTRACTIVE**.—Exists in all wines, but diminishes (by deposition) with their age.

6. **COLOURING MATTER**.—All wines contain more or less colouring matter. When grape juice, without the husk of the fruit, is fermented, the wine is pale, and is denominated *white wine*; but if the husk be present during fermentation, the wine is deep-coloured, and is usually called *red wine*. Except in the *tinilla* or *teinturier* grape, the purple colouring matter resides in the

husk, and is dissolved in the newly formed alcohol, and is reddened by the free acid. In the exception just mentioned, the colouring matter is diffused through the pulp. According to Nees von Esenbeck, the purple colouring matter of the grape resides on the inner side of the husk (epicarp). By exposure to the sun, as well as by age, the colour of wines is diminished; the colouring matter being precipitated. It may be artificially removed by milk, lime-water, charcoal, or subacetate of lead.

7. **TARTAR** (*Bitartrate of Potash*).—The most important saline constituent of wine is tartar. It is deposited, along with colouring and extractive matters, both in the cask and bottle, constituting *argol* (see Vol. I. p. 508) and the *crust*. The deposition increases with the formation of alcohol. Red wines (especially the youngest, roughest, and most coloured) contain more than white wines.

ADULTERATION.—Various impositions are said to be practised by dealers on the consumers of wines. These are almost entirely confined to the mixing of wines of various qualities. In some cases, however, the finest wines have been prepared by mixture. "From the gradual mixture of wines of various ages," observes Mr. Busby,¹ "no wine can be farther from what may be called a *natural wine* than sherry." In some cases, inferior kinds of wine are substituted by fraudulent dealers for finer ones.

To augment the strength of wine, brandy is frequently added. This is done to sherry before it is shipped from Spain. To good wines, however, it is never added in greater quantities than four or five per cent.² By recent regulations, ten per cent. of brandy may be added to wines after their arrival in this country, and while in the bonded vaults; the increased quantity only paying the wine duty.

Colouring matters are also employed to deepen or change the tint of wine. In Spain, *boiled must* (of the consistence of treacle, and having a similar flavour, but with a strong empyreumatic taste) is employed to deepen the colour of sherry. It is prepared by boiling down must to a fifth part of its original bulk.³ In this country, caramel is said to be used for a similar purpose. In Portugal, the juice of the elder-berry has been employed to augment the colour of Port-wine, the produce of poor vintages. To such an extent was this, at one time, practised, that the Wine Company of Portugal rooted out the trees, and prohibited their growth in the wine district.

Flavouring substances are also occasionally added to wines. Thus, in Spain, *Amontillado* or *Montillado* (a very dry kind of sherry) is added to sherries which are deficient in the nutty flavour. Being very light in colour, it is also used to reduce the colour of sherries which are too high. Kino and logwood are said to be used in this country to augment the astringent flavour and deepen the colour of Port-wine.

Lead, formerly used to sweeten wine,⁴ may be occasionally detected, in very minute quantity, in wine (by sulphuretted hydrogen). It is usually to be traced to shot in the bottle, and rarely to fraud.⁵

EFFECTS.—The *physiological effects* of wine next deserve our attention. Taken in moderate quantities, wine operates as a stimulant to the nervous and vascular systems, and the secreting organs. It quickens the action of the heart and arteries, diffuses an agreeable warmth over the body, promotes the different secretions, communicates a feeling of increased muscular force, excites the mental powers, and banishes unpleasant ideas. In a state of perfect health, its use can be in no way beneficial, but, on the contrary, its habitual employment in many cases proves injurious, by exhausting the vital powers, and inducing disease. The actual amount of injury it may inflict will of course vary with the quantity and quality of the wine taken, and according to the greater or less predisposition to disease which may exist in the system. Maladies of the digestive organs, and of the cerebro-spinal system, gout and dropsy, are those most likely to be induced or aggravated by it. Intoxication in its varied forms is the effect of excessive quantities of wine. It is remarkable, however, that though the effects of wine mainly depend on the alcohol

¹ *Op. supra cit.* p. 3.

² *Ibid.* pp. 4 and 11.

³ See a case in the *Phil. Mag.* liv. 229.

⁴ *Ibid.* p. 4.

⁵ See Beckmann, *Hist. of Invent.* i. 396.

contained in this liquor, yet they differ in several circumstances from those of the latter. In the first place, wine possesses a tonic influence not observed after the use of ardent spirit. Common experience proves to every one, that the stimulant influence communicated by wine is slower in its production and subsidence than that developed by spirit. In the second place, the intoxicating influence of wine is not equal to that of mixtures of ardent spirit and water of corresponding strengths, nor proportionate, in different wines, to the relative quantities of alcohol which they contain. This will be obvious from the following table, drawn up from Mr. Brande's results, before quoted:—

Average quantities of Ardent Spirit and of Wine, containing four fluidounces of Alcohol
(sp. gr. 0.825 at 60° F.).

Brandy, about	8	fluidounces.
Port Wine	18½	ditto.
Claret	26½	ditto.
Champagne	32	ditto.

Now it is obvious from this table, that if the intoxicating power of vinous liquids was in proportion to the spirit contained in them, that a pint of Port-wine would be almost equal to half a pint of brandy, and that Claret would exceed Champagne in its influence over the nervous system; all of which we know not to be the case. It is therefore obvious, that the other constituents of the wine possess the power of modifying the influence of the alcohol. Farthermore, it is probable that they are enabled to do this by being in chemical combination with the spirit; for it is asserted by connoisseurs, that a brandied wine (*i. e.* wine to which brandy has been added) is more intoxicating than a non-brandied wine equally strong in alcohol. Hence dealers endeavour to obviate this by the operation of *fretting in*, and which, in a scientific point of view, may be regarded as effecting the chemical combination of the foreign spirit with the constituents of the wine, by a second or renewed fermentation. A third distinction between the operation of wine and ardent spirit is the greater tendency of the latter to induce disease of the liver. "It is well known," observes Dr. Macculloch,¹ "that diseases of the liver are the most common, and the most formidable, of those produced by the use of ardent spirits; it is equally certain that no such disorders follow the intemperate use of pure wine, however long indulged in. To the concealed and unwitting consumption of spirit, therefore, as contained in the wines commonly drunk in this country, is to be attributed the excessive prevalence of those hepatic affections which are comparatively little known to our continental neighbours."

USES.—The *uses* of wines are threefold—dietetical, medicinal, and pharmaceutical. To persons in health, the *dietetical* employment of wine is either useless or pernicious. The least injurious are the light wines, especially Claret.

As a *medicinal agent*, wine is employed principally as a cordial, stimulant, and tonic; but some of the wines possess astringent and acid properties, for which they are occasionally resorted to. In the latter stages of fever, when languor and torpor have succeeded to a previous state of violent action, and in the low forms of this disease, wine is at times undoubtedly useful. It supports the vital powers, and often relieves delirium and subsultus tendinum, and promotes sleep. But it is much less frequently and copiously employed than formerly. As a stimulating tonic and invigorating agent, it is given in the state of convalescence from fever, and from various chronic non-febrile diseases. In extensive ulceration, copious suppuration, gangrene of the extremities, and after extensive injuries or severe operations, or profuse hemorrhages, when the powers of life appear to be failing, wine is administered often with the best effects. It has been liberally employed in tetanus, and at times with apparent alleviation of the disease. If in any of the preceding cases it causes dryness of the tongue, thirst, quick pulse, restlessness, or delirium, it should of course be immediately laid aside. And it is obvious that in acute inflammation, especially of the brain or thoracic organs, in tendency to sanguineous apoplexy, and

¹ *Op. cit.*

in the first or acute stage of fever, the employment of wine is objectionable, and calculated to prove highly injurious.

1. **PORT-WINE** (*Vinum Lusitanicum* seu *Portugalicum* [*Vinum Rubrum*, U. S.]) is applied to most of the purposes above mentioned, for which a stimulant and tonic are required, and is the wine ordinarily employed in the public hospitals of this metropolis.—On account of its astringency, it is particularly useful in those cases which are attended with a relaxed condition of the bowels; but it is apt to disagree with weak stomachs. A mixture of two thirds Port-wine and one-third water is used as an injection for the radical cure of hydrocele.

2. **BURGUNDY** (*Vinum Burgundicum*) is a stimulant, and somewhat astringent wine; but is rarely used in this country for medicinal purposes.

3. **SHERRY** (*Vinum Xericum*, Ph. L.; *Vinum Album*, Ph. Ed. [U. S.]; *Vinum album Hispanicum*, Ph. D.) is peculiarly valuable, on account of the small quantity of free acid which it contains; and it is, therefore, the wine best adapted for patients troubled with gout, or having acidity of stomach, or a deposition of lithic acid in the urine.

4. **MADEIRA** (*Vinum Maderaicum*) is a more stimulating wine than Sherry, and is, therefore, better adapted for old persons and debilitated broken-down constitutions, where its slight acidity is not objectionable. It is an excellent wine for invalids.

5. **CHAMPAGNE** (*Vinum Campanicum*) is a diuretic and a speedy intoxicator. It excites lively and agreeable feelings, and, in consequence, is adapted for hypochondriacal cases. On account of the evolution of carbonic acid, it may be occasionally employed to allay vomiting.

6. **THE RHINE WINES** (*Vinum Rhenanum*), of which *Hock* (*Vinum Hochheimense*) is the most familiar example, and the *Moselle wine* (*Vinum Mosellanum*), are refrigerant and light wines. They prove diuretic and slightly aperient. Their acidity adapts them for use where phosphatic sediments are observed in the urine. They are used also in low fever, with at least less likelihood of doing harm than the stronger wines.

7. **CLARET** (*Vinum rubellum*) has been already mentioned as one of the least injurious of wines. It is adapted for the same cases as the Rhine and Moselle wines. Both are, of course, objectionable in gouty cases and lithic acid deposits, on account of their acidity.

As a *pharmaceutical agent*, wine is employed for the preparation of the *medicated wines* (*vina medicata*). *Sherry* is the kind employed by the British colleges; but, for economy, druggists often use Cape wine. Its efficacy resides essentially in the alcohol which it contains. In some cases, however, its acidity may increase its solvent power. But as the quantity of alcohol which it contains is variable, and as it is more liable to undergo decomposition than a tincture containing the same proportion of spirit, the medicated wines are objectionable preparations.

5. **SPIRITUS VINI GALLICI**, L.—See *post*.

6. **MISTURA SPIRITUS VINI GALLICI**, L.—See *post*.

300. ALCOHOL, L. E. D. [U. S.]—ALCOHOL.

HISTORY.—Fermented liquors were known in the most remote ages of antiquity. The Sacred historian tells us¹ that, after the flood (which is supposed to have occurred 2,348 years before Christ), “Noah planted a vineyard: and he drank of the wine, and was drunken.” Homer,² the most ancient of all the profane writers whose works have reached us, and who lived more than 900 years before the Christian era, also frequently mentions wine, and notices its effects on the body and mind. Herodotus,³ who wrote 445 years before Christ, tells us that the Egyptians drank a liquor fermented from barley.

It is uncertain at what period vinous liquors were first submitted to distillation. Morewood⁴ considers the Chinese to have been acquainted with this process long before the rest of Asia, Africa, and Europe. It is usually stated, that Albucahis, who is supposed to have lived in the twelfth century, taught the mode of procuring spirit from wine.⁵ But as the process of distillation was certainly known long

¹ Genesis, ix.

² *Euterpe*, lxxvii.

³ Gmelin, *Handb. d. Chem.* ii. 271.

² *Odyssey* ix. and xvi.

⁴ *Essay on Inebriating Liquors*, p. 107, Lond. 1824.

before his time,¹ it is highly probable that his predecessors had submitted fermented liquors to this operation. Raymond Lully,² in the thirteenth century, was acquainted with spirit of wine (which he called *aqua ardens*), as well as with the mode of depriving it of water by means of carbonate of potash.

PREPARATION.—The preparation of alcohol may be divided into three stages; the production of a fermented vinous liquor; the preparation from this of an ardent spirit by distillation; and, lastly, rectification or purification.

STAGE 1. PRODUCTION OF A VINOUS LIQUOR.—When vegetable substances are placed in contact with air and moisture, they undergo that kind of decomposition which is denominated *fermentation*. The products of this process vary at different periods or stages; and on this depends the distinction into kinds or varieties of fermentation. Thus starchy liquids, under some circumstances, become saccharine; the process being termed the *saccharine* fermentation. Sugar dissolved in water, and mixed with nitrogenous matter (*ferment*), is converted into carbonic acid and alcohol; and to this process the name of *vinous* fermentation is applied. Under some circumstances, mannite, lactic acid, and a syrupy mucilage, are formed by the action of the nitrogenous or albuminous principles of vegetable juices on the sugar; this change has been denominated the *viscous* or *mucilaginous* fermentation.³ Vinous liquids are capable of generating acetic acid, and the process is denominated *acetous* fermentation. Lastly, most vegetable substances are slowly converted into gases, and a substance called vegetable mould (*humus*), constituting the process termed the *putrefactive* fermentation.

To produce a vinous liquid, it is necessary that there be present sugar (or some substance capable of forming sugar, as starch), a certain quantity of water, and a ferment (usually yeast). Moreover, a certain temperature (the best is between 70° and 80° F.) is requisite.

Both grape and cane sugar yield alcohol by fermentation. It is highly probable, however, "that cane sugar, before it undergoes vinous fermentation, is converted into grape sugar by contact with the ferment; and that, consequently, it is grape sugar alone which yields alcohol and carbonic acid."⁴ On this view, the one equivalent or 171 parts of crystallized cane sugar unite with one equivalent or 9 parts of water, to form one equivalent or 180 parts of grape sugar, which, in the process of fermentation, are converted into four equivalents or 88 parts of carbonic acid, and two equivalents or 92 parts of alcohol.

MATERIALS.		COMPOSITION.		PRODUCTS.
1 eq. Crystallized Cane Sugar 171	} 1. eq. Grape Sugar 180	4 eq. Carbon 24		4 eq. Carb. Acid 88
1 eq. water 9		8 eq. Carbon 48		
		8 eq. Oxygen 64		
		4 eq. Oxygen 32		
		12 eq. Hydrog. 12		eq. Alcohol . . 92
180	180	180		180

Vinous fermentation, then, is the metamorphosis of sugar into alcohol and carbonic acid. But as the elements of the yeast or other ferment take no part in the transformation (that is, do not enter into combination with the elements of the sugar), some difficulty has been experienced in accounting for its agency in exciting fermentation. Two opinions are entertained respecting it; by some it is regarded as a putrefying substance, whose atoms are in continual motion, which they communicate to the constituents of the sugar, and thereby destroy its equilibrium;⁵

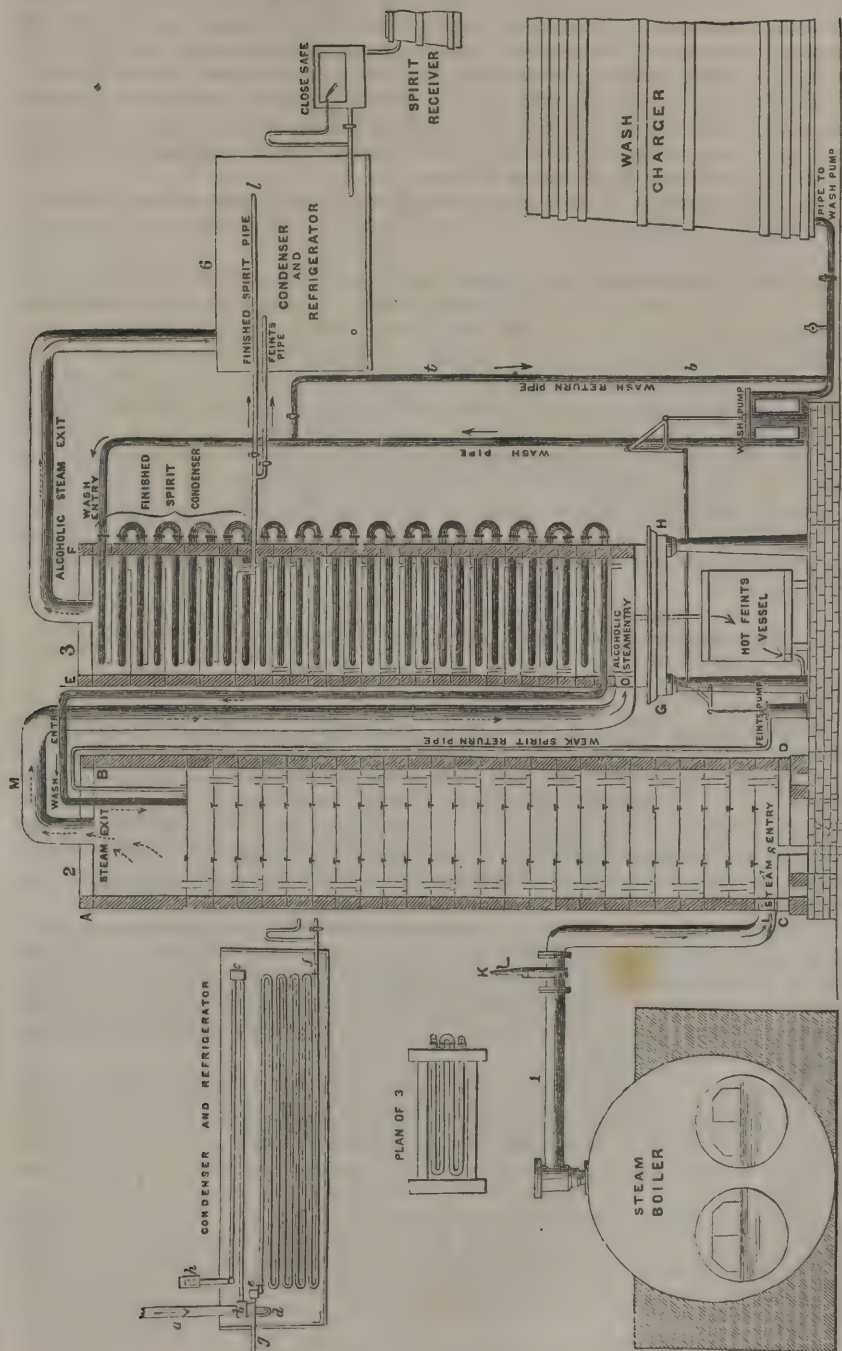
¹ Dr. Royle's *Essay on the Antiquity of Hindoo Medicine*, p. 46, London, 1837.

² Thomson's *History of Chemistry*, i. 41, Lond. 1830; *Testamentum Novissimum*, edit. Basil, p. 2 1600.

³ Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 937. London, 1840.

⁴ *Ibid.* p. 946.
⁵ The view above referred to is that entertained by Liebig; for full details of it I must refer to his work, entitled *Organic Chemistry, in its Application to Agriculture and Physiology*, edited by L. Playfair, Ph. D., Lond. 1840; and Turner's *Elements of Chemistry*, 7th ed. p. 944, 1840. Berzelius (*Journ. de Chimie Médicale*, t. iii. p. 425, 2de Série, 1837) ascribes decompositions of this kind, which are effected by the mere contact of one body with another, to a new force which he supposes to be called into action, and which he denominates *catalytic force* (from *καταλύω*, I loosen or dissolve).

Fig. 390.



Improved Apparatus for the Distillation of Spirit.

by others, yeast¹ is considered to consist essentially of seeds or sporules, whose vegetation is the immediate cause of the metamorphosis of the sugar. The liquid obtained by the vinous fermentation has received different names, according to the substance from which it is obtained. When procured from the expressed juices of fruits, as grapes, currants, gooseberries, &c., it is denominated *Wine* (*Vinum*); from a decoction of malt and hops, *Ale* or *Beer* (*Cererisia*);² and from a mixture of honey and water *Mead* (*Hydromeli*). Fermented infusions of barley (raw grain and malt), prepared by the distillers of this country for the production of ardent spirit, are technically denominated *Washes*.

The liquid obtained by vinous fermentation consists of *water, alcohol, colouring and extractive matters, ceanthic ether, volatile oil* (e. g. oil of potatoes, oil of grain, &c.), *various acids and salts*.

STAGE 2. PRODUCTION OF ARDENT SPIRITS.—By the distillation of a vinous liquid, we obtain *Ardent Spirit* (*Spiritus Ardens*). When grape wine is employed, the spirit is called *Brandy* (*Spiritus Vini Gallici*, Ph. L.); when the vinous liquid is obtained by the fermentation of molasses or treacle, the spirit is termed *Rum* (*Spiritus Sacchari*); when the liquid is a fermented infusion of grain (*Wash*), the spirit is denominated *Corn Spirit* (*Spiritus Frumenti*); and when the vinous liquid is either a fermented infusion of rice or toddy (*Palm Wine*), the spirit is named *Arrack* (if from the former, it is termed *Spiritus Oryzæ*). The well-known liquors called *Gin, Hollands or Geneva*, and *Whiskey*, are corn spirits flavoured.

Ardent spirit, from whatever source obtained, consists of *water, alcohol, volatile oil*, and, frequently, *colouring matter*. The following are, according to Mr. Brande,³ the average quantities of alcohol (sp. gr. 0.825 at 60° F.) in some kinds of ardent spirit:—

100 parts (by measure) of	Alcohol (by measure).	100 parts (by measure) of	Alcohol (by measure).
Brandy contain	55.39	Whiskey (Scotch) contain . .	54.32
Rum	53.68	Whiskey (Irish)	53.20
Gin	51.60		

Each variety of ardent spirit has an aroma peculiar to itself, which is characteristic of the substance from which it is produced. This depends on volatile oil.

When wash is distilled, the fluid that comes over is called *Singlings*, or *Low Wines*. It is concentrated or *doubled* by a second distillation, by which *Raw Corn Spirit* is obtained. Towards the end of the distillation, the distilled product acquires an unpleasant odour and taste from the presence of volatile oil, and is called *Faints*. Raw corn spirit is sold by the distiller to the rectifier at 11 or 25 per cent. *over proof*, in the language of Sikes's hydrometer.

STAGE 3. RECTIFICATION.—The object of the rectifier is to deprive ardent spirit of its volatile oil and water. This is effected by repeated distillations, and by the use of pearlash (carbonate of potash), which, by its powerful affinity for water, checks the rise of this fluid in distillation. In this way is procured the liquid called *Rectified Spirit* (*Spiritus Rectificatus*, L. E. D.), which is sold by the rectifier to the chemist or apothecary.

1. CORN SPIRIT OIL; Oil of Grain; Potato Spirit Oil; Fuselöl; Hydrate of Amyle; Amylic Alcohol; Bihydrate of Amyline.—All ardent spirits contain a volatile oil, which the Germans⁴ call *Fuselöl*. In 1825, Pelletan⁵ described that obtained from Potato Spirit, and which has been subsequently examined in 1838, by Dumas,⁶ and in 1839 by Cahours.⁷ The oil from corn spirit was described several years ago by Buchner.⁸ It has been long known to Messrs. Bower-

¹ The Yeast Plant has been already described and figured in a former part of this work, to which the reader is referred (*See Fermentum Cerevisiæ*, p. 80, *ante*). For farther details, consult the Memoirs of Schwann (*Poggendorfs Annalen der Physik*, Bd. xli. p. 181; *Pharmaceutisches Central-Blatt für 1837*, S. 547; and Meyen's *Report on the Progress of Vegetable Physiology during the year 1837*, Lond. 1839), Cagniard-Latour and Turpin (*Biblioth. Univ. de Genève*, Nov. 1838; and Jameson's *Edinb. New Phil. Journ.* vol. xxv.), Ketzling (*Repertoire de Chimie*, t. iii. Paris, 1838), Quevenne (*Journ. de Pharm.* t. xxiv.), and Turpin (*Mémoires de l'Académie Royale des Sciences de l'Institut*, t. xvii. Paris, 1840).

² See *ante*, p. 118.

³ L. Gmelin, *Handb. de Chemie*, Bd. ii. S. 367.

⁴ *Ann. de Chim. et de Physiq.* t. xxx. p. 221; and *Journ. de Chim. Méd.* t. i. p. 76.

⁵ *Ann. de Chim. et de Physiq.* t. lvi. p. 314.

⁶ *Repertorium*, xxiv. 270.

⁷ *Phil. Trans.* for 1811 and 1813.

⁸ *Ibid.* t. lxx. p. 81.

bank, rectifiers, of London, who obtain it in the rectification of corn spirit. From them I procured it several years ago, under the name of *Oil of grain*; and, in 1836, noticed it in my lectures.¹ In 1839, I gave a short description of its properties in the first edition of this work. It has since been more completely examined by Dr. Apjohn.² Under the name of *Oleum siticum*, Mulder³ has described a peculiar oil, which he obtained from corn spirit.

Oil of grain, as I received it from Messrs. Bowerbank, is a limpid, transparent liquid, of a pale yellow colour, and having a very nauseous odour and an acid taste. The inhalation of its vapour produces an unpleasant and persistent sensation in the throat. When washed with water (to remove the alcohol), and subsequently distilled from chloride of calcium (to deprive it of water), it is quite colourless, and had, according to my experiments, a sp. gr. of 0.833 at 56° F. [0.813 at 60°, *Apjohn*]. It boils at about 268° F. Dr. Apjohn failed to congeal it at —6° F.; but Cahours congealed the oil from potato spirit at —4° F. It burns in the atmosphere with a flame like that of light carburetted hydrogen gas [with a bluish-white flame, *Cahours*]. It dissolves iodine; and, according to Dr. Apjohn, is a good solvent for fats, resins, and camphor. It is not miscible with water, which, however, sparingly dissolves it. Neither is it miscible with liquor ammoniæ, nor with liquor potassæ. It dissolves in nitric acid, but acquires a slightly yellowish-red tinge; and, when the mixture is heated, violent reaction takes place; nitrous fumes mixed with nitric ether are so rapidly evolved, that, if the experiment be performed in a tubulated retort, the stopper is sometimes driven out with considerable violence. When mixed with oil of vitriol, a violet- or blood-red-coloured thick liquid, with the evolution of a mint-like odour, is produced, and, according to Cahours, *sulphoamylic acid* (bisulphate of oxide of amyle $C^{10}H^{11} + O + 2SO^2 + Aq.$ is formed. When distilled with dry phosphoric acid, it yields, according to the same authority, a carbo-hydrogen called *amylene* ($C^{10}H^{10}$). Potassium readily decomposes it with the evolution of hydrogen. If it be heated with fused potash, hydrogen is disengaged, and a compound of potash and *valerianic acid* ($C^{10}H^9O^3 + Aq.$) is formed.

This oil is composed of carbon, hydrogen, and oxygen. Cahours regards it as the hydrated oxide of a hypothetical base, called *amule* or *amyle* ($C^{10}H^{11}$), and Liebig has adopted his views.

	Atoms.	Eq. Wt.	Per Ct.	Apjohn.	Dumas.	Cahours.	Or,	Atoms.	Eq. Wt.
Carbon . . .	10	60	68.18	68.13	68.6	68.90	Amule	1	71
Hydrogen . .	12	12	13.64	13.33	13.6	13.58	Oxygen	1	8
Oxygen . . .	2	16	18.18	18.54	17.8	17.52	Water	1	9
<hr/>									
Corn Spirit } Oil . . . }	1	88	100.00	100.00	100.0	100.00	Hydrate of Oxide . . } of Amule }	1	88

I am informed by Messrs. Bowerbank, that they obtain from 500 gallons of corn spirit about one gallon of oil, which they employ as a substitute for lamp oil.

[This preparation, under the name of *Alcohol Amylicum*, or Fusel Oil, has been introduced into the Supplement of the last *Dublin Pharmacopœia*.

Take of the light liquid which may be obtained at any large distillery by continuing the distillation for some time after the pure spirit has been all drawn off, any convenient quantity.

Introduce it into a small still or retort connected with a condenser, and apply heat so as to cause distillation. As soon as the oil begins to come over unmixed with water, the receiver should be changed, and the distillation being resumed, and carried nearly to dryness, the desired product will be obtained. The liquid drawn over during the first part of the distillation will consist of an aqueous fluid, surmounted by a stratum of the fusel oil. This latter, though impregnated with a minute quantity of water, should be separated and preserved as being sufficiently pure for use.—*Ed.*]

2. *ÆNANTHIC ACID AND ÆNANTHIC ETHER*.—The only liquid obtained in the distillation of wine is a mixture of *Ænanthic acid* and *Ænanthic ether*. (See *Vinum*, ante, p. 892).

PROPERTIES OF RECTIFIED SPIRIT.—The liquid sold by rectifiers as rectified spirit (*Alcohol Dilutum*, L.; *Spiritus Rectificatus*, E. D.) varies from 54 to 60, or even 64 per cent. over proof, in the language of Sikes's hydrometer. Hatters employ that at 54 or 56; varnish-makers that at 58 per cent. over proof. The London College fixes the sp. gr. at 0.838 at 62° F.; the Edinburgh College at 0.838, or under, at 60° F.; the Dublin College at 0.840; [the *U. S. Pharmacopœia* at 0.835.]

Purity. Rectified spirit, besides having the specific gravity above mentioned, should be colourless, transparent, and not rendered turbid on the addition of water. "In taste and smell it resembles wine." (*Ph. L.*) Its freedom from other substances than alcohol and water is to be determined partly by the purity of its

¹ *London Medical Gazette*, vol. xviii. p. 963.

² *London. Edin. and Dubl. Phil. Mag.* vol. xvii. p. 86, 1840.

³ *Pharmaceutisches Central-Blatt für 1837*, S. 807 —*Siticus*, from *στικίς*, of or pertaining to corn.

odour, by the absence of any acid or alkaline reaction, and by its easy and complete volatility. It is frequently contaminated with the *oil of corn spirit*; of the presence of which there are two tests, sulphuric acid and nitrate of silver. If colourless oil of vitriol be added to rectified spirit, it causes a red tinge if the oil be present. According to Vogel, nitrate of silver is a more delicate test for the oil; if it be mixed with spirit, and exposed to solar light, it becomes red if any oil be present, but undergoes no change of colour if the spirit be pure. The following are the directions of the Edinburgh College for the application of this test:—

“Four fluidounces [of rectified spirit] treated with 25 minims of solution of nitrate of silver [*Ph. Ed.*], exposed to bright light for twenty-four hours, and then passed through a filter purified by weak nitric acid, so as to separate the black powder which is formed, undergo no farther change when exposed to light with more of the test.

The peculiar odour which spirit obtained from brandy or whiskey possesses, depends on a volatile oil, which “is best removed, on the small scale, by rectification with a little caustic potash (Göbel, Liebig), or by digesting the spirits with freshly-ignited pine charcoal.”¹

PROOF SPIRIT (*Spiritus tenuior*, L. E. D.)—The sp. gr. of proof spirit is fixed by law at 0.920. [The *London College* directs that it should be made by adding to every five pints of Rectified Spirit (*Spiritus Rectificatus*, or *Alcohol Dilutum*, sp. gr. 0.838) three pints of distilled water at a temperature of 62°. The *Edinburgh College* orders of rectified Spirit (sp. gr. 0.838) $\bar{\text{z}}$ xxi, and of Distilled Water $\bar{\text{z}}$ xij, or a sufficiency. The *Dublin College* orders of Rectified Spirit (sp. gr. 0.840) seven pints, Distilled Water, four pints. Mix. The specific gravity is 0.920. This College prepares a stronger spirit, called *Spiritus Fortior*, by agitating eight ounces of carbonate of potash, dried at a low red heat, with half a gallon of rectified spirit, separating the upper stratum by decantation, and distilling the liquid thus separated in a chloride of zinc bath, with a Liebig's condenser, until the product amounts to seventy-two ounces. The specific gravity of the *Spiritus Fortior* is 0.818. It is an intermediate compound between Alcohol and Rectified Spirit.—*Ed.*] The tests of the purity of *Proof Spirit* are the same as for Rectified Spirit.]

[The **ALCOHOL DILUTUM**, *U. S.* is made with a pint of Alcohol, *U. S.* and a pint of Distilled Water; sp. gr. 0.935.]

PREPARATION OF ALCOHOL.—*Alcohol* (E. D.) is prepared by the chemist from the rectified spirit purchased of the rectifier. It is obtained by adding chloride of calcium, carbonate of potash, or well-burnt lime, to the spirit, which is then submitted to distillation. The salts or lime retain the water, while the alcohol distils over. The Pharmacopœia of the *London College* contains no process for the preparation of alcohol.

The *Edinburgh College* directs “Rectified Spirit Oj; Lime well burnt $\bar{\text{z}}$ xviiij. Break down the lime into small fragments; expose the spirit and lime together to a gentle heat in a glass matrass till the lime begins to slake; withdraw the heat till the slaking is finished, preserving the upper part of the matrass cool with damp cloths. Then attach a proper refrigeratory, and with a gradually-increasing heat, distil off seventeen fluidounces. The density of this alcohol should not exceed 0.796; if higher, the distillation must have been begun before the slaking of the lime was finished.

The *Dublin College* takes of Spirit rectified by Carbonate of Potash (*Spiritus Fortior*), of a sp. gr. 0.818, Oj; Pulverized fresh-burnt Lime $\bar{\text{z}}$ x. This mixture is to be distilled by means of a chloride of zinc bath until a product of nearly $\bar{\text{z}}$ xvj, of a sp. gr. 0.795, is procured. The first two ounces are to be rejected.

PROPERTIES OF ALCOHOL.—Alcohol is a limpid, colourless, inflammable liquid, having a peculiar and penetrating odour, and a burning taste. Its sp. gr. at 60° F. is 0.7947; at 68° F. it is 0.792—0.791. It is obvious, therefore, that the *Alcohol* of the *Edinburgh* and *Dublin* colleges is a mixture of alcohol, properly so called, and water. No means of solidifying it are at present known. [It has been exposed by Faraday to a cold of 166°, by means of a bath of solid carbonic acid and

¹ Turner's *Elements of Chemistry*, p. 829, 7th edit. Lond. 1840.

ether. It acquired the consistency of castor-oil, but did not solidify.—ED.] It boils at 172° F.; every volume of the boiling liquid gives 488.3 volumes of vapour, calculated at 212° F. It is very combustible. In atmospheric air it burns with a pale blue flame, giving out a very intense heat, and generating carbonic acid and water, but depositing no carbon, unless the supply of oxygen be deficient. The colour of the flame may be variously tinted—as yellow by chloride of sodium, whitish-violet by chloride of potassium, green by boracic acid or a cupreous salt, carmine red by chloride of lithium, crimson by chloride of strontium, and greenish-yellow by chloride of barium.

Alcohol has a strong affinity for water; hence it abstracts this fluid from the atmosphere, and precipitates from their watery solution those salts (*e. g.* sulphate of potash) which are not soluble in spirit; while, on the other hand, water precipitates from their alcoholic solution those substances (*e. g.* resin and oil) not soluble in water. By the mixture of alcohol and water, heat is evolved, while air-bubbles are so copiously developed, that for a few moments the liquid appears turbid. When cold, the resulting compound is found to possess a greater density than the mean of its constituents; but as the condensation varies with the proportions of alcohol and water employed, the sp. gr. of the resulting compound can be ascertained by experiment only. The maximum condensation is obtained by mixing 54 vols. of alcohol with 49.77 vols. of water; the resulting compound measures 100 vols., so that the condensation is 3.77. If we regard this as a definite compound of alcohol and water, its composition may thus be stated:—

Rudberg.					
	Eq.	Eq. Wt.	Per Cent. Wt.	Vols.	Weight.
Alcohol	1	23	46	54.00	42.91
Water	3	27	54	49.77	49.77
Terhydrate of Alcohol .	1	50	100	100.00	92.68
[condensation 3.77]					

Alcohol combines with certain salts (as the chlorides and nitrates) to form definite compounds, which have been termed *alcohates*, in which the alcohol appears to act as a substitute for the water of crystallization. Alcohol is a solvent of many organic substances, as volatile oil, fixed oil, resin, extractive, most varieties of sugar, many nitrogenous organic acids, the vegetable alkalies, urea, caseine, gliadine, leucine, and osmazome. It prevents the putrefaction of animal substances, and is, in consequence, extensively employed in the preservation of anatomical preparations. It acts, in part at least, by excluding air (oxygen) and water, the two powerful promoters of putrefaction; for when animal substances are immersed in spirit, this fluid abstracts water from the tissue, which, in consequence, shrivels up, and thus prevents putrefaction, by removing one of the essential conditions to its production, namely, the presence of water. Its attraction for water, and its power of coagulating albuminous substances, are properties which probably assist in rendering it an antiseptic. Alcohol and rectified spirit of wine give greater firmness to and whiten the animal tissues. The latter property is objectionable in the preservation of some morbid specimens, as gelatiniform cancer (*cancer gélatiniforme* or *aréolaire* of Cruveilhier—the *matière colloïde* of Laennec). A mixture of one part rectified spirit and three water will, however, preserve specimens of the last-mentioned disease in a transparent condition.

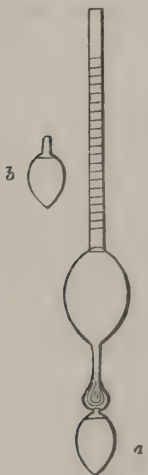
CHARACTERISTICS.—Alcohol and ardent spirits are recognized by their inflammability, odour, taste, and miscibility with water. They dissolve camphor and resin. In order to detect alcohol in liquids supposed to contain it, let the suspected liquor be submitted to distillation with a gentle heat (as from a vapour or water-bath), and to the distilled liquid add dry carbonate of potash, to abstract the water. The alcohol floats on the surface of the alkaline solution, and may be recognized by the characters above mentioned [especially by its power of dissolving camphor].

COMPOSITION.—The elementary constituents of alcohol are carbon, hydrogen, and

oxygen; [and, according to the views of modern chemists, the formula for this compound is $C^2H^6O^2=46$, or $Ae\ O + HO$; *i. e.* alcohol is regarded as a hydrated oxide of ethyle, a compound radical, which has recently been procured in a separate state by Dr. Frankland.—ED.]

ALCOHOLOMETRY.—The value of ardent spirit is, of course, proportionate

Fig. 391.



Hydrometer, with one of its ballast weights (a).
b. Another weight.

to the quantity of alcohol contained therein, and, therefore, a ready mode of estimating this is most desirable. The alcoholometrical method usually adopted consists in determining the sp. gr. of the liquid by an instrument called the *hydrometer* (from *ὑδωρ*, *water*, and *μετρον*, *a measure*). That employed in this country, in the collection of the duties on spirits, is called *Sikes's hydrometer* (Fig. 391). Spirit having the sp. gr. 0.920, at 60° F., is called *proof spirit*; that which is heavier is said to be *under proof*, while that which is lighter is called *over proof*. The origin of these terms is as follows: Formerly, a very rude mode of ascertaining the strength of spirits was practised, called the *proof*; the spirit was poured upon gunpowder, in a dish, and inflamed. If at the end of the combustion the gunpowder took fire, the spirit was said to be *above* or *over proof*; but if the spirit contained much water, the powder was rendered so moist that it did not take fire; in this case, the spirit was declared to be *below*, or *under proof*. As spirit of different strengths will or will not inflame gunpowder, according to the quantity of spirit employed, it became necessary to fix the legal value of proof spirit. *Spiritus tenuior*, Ph. L., is defined by act of parliament to be such, that at the temperature of 51° F., thirteen volumes of it weigh exactly as much as twelve volumes of water. According to this definition, the sp. gr. at 60° F. is 0.920, and spirit of this strength consists of—

	By Weight.	Sp. Gr.
Alcohol	49	0.791
Water	51	1.000
Proof spirit	100	0.920

Spirit which is of the strength of 43 *per cent. over proof* at the least, is recognized by the legislature¹ as *spirits of wine*. All spirit under this strength is known in trade as *plain spirit*. Distillers are not permitted² to send out spirits at any other strengths than 25 or 11 *per cent. above*, or 10 *per cent. below proof*. Raw corn spirit, therefore, is sold at 25 or 11 *per cent. above proof*. *Compound spirits* (as *Gin*) are not allowed³ to be kept or sent out stronger than 17 *per cent. under proof*; but *Gin*, as sold by the rectifier, is usually 22 *per cent. under proof*. *Foreign or Colonial spirits* (not being compounded colonial spirits) must not be kept or sent out of less strength than 17 *per cent. under proof*.⁴ Rum and Brandy, as commonly sold, are 10 *per cent. under proof*.

A series of carefully drawn-up tables, showing the relation which exists between the sp. gr. of spirit of different strengths, and the indications of Sikes's hydrometer, is a great desideratum. Mr. Gutteridge⁵ has published some tables; but several of his statements do not coincide with experiments which I have made on the subject. The following are extracts from his work:—

¹ 6 Geo. IV. cap. 80, Sects. 101 & 114.

² Ibid. Sect. 124.

³ Ibid. Sect. 61.

⁴ Ibid. Sect. 130.

⁵ *The Ne Plus Ultra of Assaying, Weighing, Measuring, and Valuing of Spirituous Liquors*, vol. ii. By W. Gutteridge. London, 1828.

SIKES'S HYDROMETER.			SIKES'S HYDROMETER.		
		Sp. Gr. at 60° F.			Sp. Gr. at 60° F.
Over proof.	70 per centum	0.8095	Proof	5 per centum	0.9259
	64	0.8221	10		0.9318
	63.1	0.8238	11		0.9329
	62	0.8259	15.3		0.9376
	61.1	0.8277	17.1		0.9396
	60	0.8298	20		0.9426
	59.1	0.8315	22.3		0.9448
	58	0.8336	23.1		0.9456
	57.1	0.8354	25.1		0.9476
	56	0.8376	30.1		0.9522
	55.9	0.8379	40.1		0.9603
	55.7	0.8383	50.3		0.9673
	55.0	0.8396	60.4		0.9734
	54.1	0.8413	70.1		0.9790
	50.1	0.8452	80.4		0.9854
Under Proof.	43.1	0.8597	90.2		0.9922
	25	0.8869	100 (water)		1.0000
	11.1	0.9060			

The sp. gr. of spirit may be readily ascertained by *Lové's beads*, or by the *specific gravity bottle*.

Table of the Specific Gravities of Mixtures of Spirit (0.825 at 60° F.) and Water at 60° F.¹

Temperature 60° F.		Sp. gr.	Temperature 60° F.		Sp. gr.
Spirit 100	Water 0	0.82500	Water 100	Spirit 95	0.93247
" 100	" 5	0.83599	" 100	" 90	0.93493
" 100	" 10	0.84568	" 100	" 85	0.93749
" 100	" 15	0.85430	" 100	" 80	0.94018
" 100	" 20	0.86208	" 100	" 75	0.94296
" 100	" 25	0.86918	" 100	" 70	0.94579
" 100	" 30	0.87568	" 100	" 65	0.94876
" 100	" 35	0.88169	" 100	" 60	0.95181
" 100	" 40	0.88720	" 100	" 55	0.95493
" 100	" 45	0.89232	" 100	" 50	0.95804
" 100	" 50	0.89707	" 100	" 45	0.96122
" 100	" 55	0.90144	" 100	" 40	0.96437
" 100	" 60	0.90519	" 100	" 35	0.96752
" 100	" 65	0.90927	" 100	" 30	0.97074
" 100	" 70	0.91287	" 100	" 25	0.97409
" 100	" 75	0.91622	" 100	" 20	0.97771
" 100	" 80	0.91933	" 100	" 15	0.98176
" 100	" 85	0.92225	" 100	" 10	0.98654
" 100	" 90	0.92499	" 100	" 5	0.99244
" 100	" 95	0.92758	" 100	" 0	1.00000
" 100	" 100	0.93002			

Another mode of judging of the strength of spirits is the phial test, technically called the *bead*; the *preuve d'Hollande* of the French. It consists in shaking the spirit in a phial, and observing the size, number, and bursting of the bubbles (or beads as they are termed); the larger and more numerous the beads, as well as the more quickly they break, the stronger the spirit. Hitherto chemical analysis has been of little avail in determining the strength of spirit, at least for commercial purposes; for, on the one hand, we are yet in want of an accurate method of determining the relative quantities of alcohol and water in mixtures of these fluids; while, on the other, the combustion of spirit by the black oxide of copper, and the estimation of the quantity of alcohol by the carbonic acid produced, is impracticable for ordinary purposes.

[The strength of alcoholic liquids may be, in general, determined by the following process. Place four ounces of the liquid in a retort, and distil two ounces at a very low temperature. Make up the distilled liquid in the receiver to four ounces with distilled water, and agitate the mixture until the liquids are thoroughly incorporated. When the mixture is quite cold, its specific gravity may be taken by the bottle, and the temperature being noted, its strength may be read off by the aid of the above table.—ED.]

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Alcohol acts on plants as a rapid and fatal poison. Its effects are analogous to those of hydrocyanic acid.

β. On Animals.—Leeches immersed in spirit die in two or three minutes. Their

¹ Drawn up from Gilpin's Tables in the *Philosophical Transactions* for 1792.—The spirit, which Mr. Gilpin called alcohol, was composed of 89 alcohol (sp. gr. 0.796 at 60° F.) and 11 water.

bodies are shrivelled or contracted, and before death they make but few movements; the head and tail of the animal are drawn together. Fontana¹ found, that when half the body of a leech was plunged in spirit, this part lost all motion, whilst the other half continued in action. The same experimentalist observed, that spirit killed frogs, when administered by the stomach (in doses of 40 drops), injected beneath the skin, or when applied to the brain or spinal marrow. Plunging the heart of this animal into spirit caused its motion to cease in twenty seconds. Applied to the right crural nerve of a frog, it destroyed the power of moving in the right foot, on the application of stimulus. Monro² observed that alcohol applied to the hind legs of a frog rendered the pulsations of the heart less frequent, and diminished sensibility and mobility. Fontana³ states, that turtles were killed by spirit administered by the stomach or by the anus, or injected beneath the skin; before death, the animal became motionless; applied to the heart of these animals, it destroyed the contractility of this viscus. Some very interesting experiments were made with spirit on birds by Flourens.⁴ This distinguished physiologist administered six drops of alcohol to a sparrow, whose skull he had laid bare. In a few minutes the animal began to be unsteady both in walking and flying. After some time a dark-red spot appeared on the skull, in 'the region of the cerebellum, and became larger and deeper-coloured in proportion as the alcohol more powerfully affected the animal. I have given alcohol to birds, but have hitherto been unable to discover the physical changes here stated. In some other experiments, Flourens observed that alcohol produced the same effects on the movements of birds as the removal of the cerebellum occasioned, but that, when alcohol was administered, the animal lost the use of his senses and intellectual faculties; whereas, when the cerebellum was removed, no alcohol being given, he preserved them. From these and other observations, Flourens is of opinion that alcohol, in a certain dose, acts specifically on the cerebellum, and that in larger doses it affects other parts also. Furthermore, he thinks the physical action of alcohol on the cerebellum to be absolutely the same as a mechanical lesion.

The effect of alcohol on fishes is analogous to that on other animals. If a little spirit be added to water, in which are contained some minnows (*Cyprinus phoxinus*, Linn.), the little animals make a few (spasmodic?) leaps, and become incapable of retaining their proper position in the water, but float on their sides or back. If removed into pure water, they soon recover.

The mammals, on which the effects of alcohol have been tried, are dogs, cats, horses, rabbits, and guinea-pigs. The principal experimentalists are, Courten,⁵ Fontana,⁶ Viborg,⁷ Brodie,⁸ and Orfila.⁹ The results of their experiments may be thus briefly expressed: Four drachms of alcohol, injected into the jugular vein of a dog, coagulated the blood, and caused instant death (Orfila). Introduced into the stomach of cats, dogs, or rabbits, it produces an apoplectic condition (Brodie and Orfila); this state is preceded, according to Orfila, by a strong excitement of the brain. The same experimentalist found that alcohol acts with less energy when injected into the cellular texture, than when introduced into the stomach; from which he infers that its first effects are the result of the action which it exerts on the extremities of the nerves; though he admits that ultimately it becomes absorbed. On examining the bodies of animals killed by introducing alcohol into the stomach, this viscus has been found in a state of inflammation.

γ. *On Man*.—The effects of alcoholic liquors on man vary with the strength of the liquid, the substances with which the alcohol is combined, the quantity taken, and the constitution of the patient.

¹ *Treatise on the Venom of the Viper*, translated by J. Skinner, vol. ii. p. 371, *et seq.*

² *Essays and Observ. Physic. and Literary*, vol. iii. p. 340.

³ *Recherches sur les fonctions et les propriétés du système nerveux dans les animaux vertébrés*, Paris, 1824.

⁴ *Philosophical Transactions* for 1712.

⁵ *Abhandl. für T. ierazte*, Theil II. quoted by Wibmer, *Die Wirkung*, &c.

⁶ *Philosophical Transactions* for 1811.

⁷ *Op. cit.* p. 365, *et seq.*

⁸ *Op. supra cit.*

⁹ *Toxicologie Générale*.

aa. *The local effects of alcohol or rectified spirit* are those of a powerfully irritant and caustic poison. To whatever part of the body this agent is applied, it causes contraction and condensation of the tissue, and gives rise to pain, heat, redness, and other symptoms of inflammation. These effects depend partially or wholly on the chemical influence of alcohol over the constituents of the tissues; for the affinity of this liquid for water causes it to abstract the latter from soft living parts with which alcohol is placed in contact; and when these are of an albuminous or fibrinous nature, it coagulates the liquid albumen or fibrin, and increases the density and firmness of the solid albumen or fibrin. The irritation and inflammation set up in parts to which alcohol is applied, depend (in part) on the resistance which the living tissue makes to the chemical influence of the poison; in other words, it is the reaction of the vital powers brought about by the chemical action of alcohol. But, besides the local influence of this liquid, dependent on its affinity, we can hardly refuse to admit a dynamical action, in virtue of which it sets up local irritation and inflammation, independent of its chemical agency. The coagulation of the blood contained in the vessels of the part to which this liquid is applied (an effect which Orfila observed when he killed an animal by injecting alcohol into the cellular tissue of the thigh of a dog), depends on the chemical influence of the poison.

ββ. *The remote effects of ardent spirits* on man may be conveniently considered in the order of their intensity; and for this purpose we may divide them into three degrees or stages.¹

1. **FIRST OR MILDST DEGREE. EXCITEMENT.**—This is characterized by excitement of the vascular and nervous systems. The pulse is increased in frequency, the face flushed, the eyes animated and perhaps red, the intellectual functions are powerfully excited, the individual is more disposed to joy and pleasure; cares disappear; the ideas flow more easily and are more brilliant. At this period, the most violent protestations of love and friendship are frequently made; there is a strong disposition to talk, and various indiscretions are oftentimes committed (*In vino veritas*). This degree of effect I presume to be the condition to which all persons aspire in drinking; the unfortunate drinks to drown his cares; the coward to give him courage; the *bon-vivant* for the sake of enjoying the society of his friends; the drunkard for mere sensuality. None, perhaps, would wish to go beyond this; yet many, when they have got thus far, exceed their intended limit.

2. **SECOND DEGREE. INTOXICATION, OR DRUNKENNESS.**—The essential character of this stage is a disordered condition of the intellectual functions and volition; manifested by delirium, varying in its characters in different individuals, and by an incapability of governing the action of the voluntary muscles. This state is accompanied with excitement of the vascular system, and frequently with nausea and vomiting; it is followed by an almost irresistible desire for sleep, which usually continues for several hours, and is attended with copious perspiration. When the patient awakes, he complains of headache, loathing of food, great thirst, and lassitude; the tongue is furred and the mouth clammy.

During a paroxysm of drunkenness, certain peculiarities are observed in the character of the delirium in different individuals. These appear to depend on what is commonly denominated temperament. Mr. Macnisi² has offered a classification of drunkards, founded on these peculiarities. He describes the *sanguineous drunkard*, the *melancholy drunkard*, the *surlly drunkard*, the *phlegmatic drunkard*, the *nervous drunkard*, and the *choleric drunkard*.

3. **THIRD DEGREE. COMA, OR TRUE APOPLEXY.**—This condition is usually observed when excessive quantities of spirit have been swallowed in a short time. According to Dr. Ogston, the patient is sometimes capable of being roused; the pulse is generally slow, the pupils are usually contracted, but more commonly dilated, and the breathing is for the most part slow; but exceptions exist to all these statements. Convulsions are rare; when they occur, the patients are usually young. In some cases, actual apoplexy (with or without sanguineous extravasation) is brought on. The immediate cause of death appears to be either paralysis of the muscles of respiration, or closure of the glottis.

¹ The newspaper reports of the proceedings at the Metropolitan Police Offices furnish examples of the employment, by the lower classes, of certain terms to designate the different degrees of the effects of fermented and spirituous liquors. When an individual is merely excited, he is described as *fresh*; but neither tipsy nor drunk. When the disordered intellect is just commencing, he is said to be *half seas over*. When he is beginning to be unsteady in his gait, he is described as being *tipsy*. When he reels, falls about, is incapable of standing, but is yet sensible, he is said to be *drunk*. And, lastly, when he is insensible, or nearly so, he is described as *dead drunk*.—Sir Walter Scott (*Waverley*) distinguishes *fuddled* or *half seas over* (*ebriolus*) from *drunken* (*ebrius*).

² *The Anatomy of Drunkenness*, 2d ed. p. 43, Glasgow, 1826.

CONSEQUENCES OF HABITUAL DRUNKENNESS.—The continued use of spirituous liquors gives rise to various morbid conditions of system, a few only of the most remarkable of which can be here referred to. One of these is the disease known by the various names of *delirium tremens*, *d. potatorum*, *oinomania*, &c., and which is characterized by delirium, tremor of the extremities, watchfulness, and great frequency of pulse. The delirium is of a peculiar kind. It usually consists in the imagined presence of objects which the patient is anxious to seize or avoid. Its pathology is not understood. It is sometimes, but not constantly, connected with, or dependent on, an inflammatory condition of the brain or its membranes. Sometimes it is more allied to nervous fever. Opium has been found an important agent in relieving it.

Insanity is another disease produced by the immoderate and habitual use of spirituous liquors. In 110 cases of this disease, occurring in male patients admitted into the Hanwell Asylum in 1840, no less than 31 were ascribed to intemperance, while 34 were referred to combined causes, of which intemperance was stated to be one. It is remarkable, however, that of 70 female patients, admitted during the same year, only four cases were ascribed to intemperance.¹

Disease of the liver is frequently met with in drunkards who use ardent spirits. It is generally of the kind termed, by Baillie, *common tubercle of the liver*; by Dr. Elliotson,² the *gin liver*; by others, *granulated*, *lobulated*, *mamellated*, or *scirrhus liver*. Laennec calls it *cirrhosis* (from *καρρός*, yellowish), in reference to its usual tawny, yellow colour. A beautiful representation of it is given by Cruveilhier.³ Dr. Carswell⁴ has described it as consisting in atrophy of the lobular structure of the liver, produced by the presence of a contractile fibrous tissue. It is not, therefore, a disease depending on the formation of a new tissue. The ascites, which so frequently accompanies it, arises from the compression to which the portal vessels are subjected by the fibrous tissue; and the jaundice, another frequent effect of it, doubtless depends on compression of the gall ducts. Some excellent remarks on this disease have been made by the late Dr. Hope.⁵

Stomach affections are common results of dram-drinking. Persons addicted to the use of ardent spirits suffer from loss of appetite, and are usually dyspeptic; and chronic inflammation of the stomach, or even a scirrhus state of the pylorus, has been said to be occasionally produced by hard drinking.

Dram-drinkers are sometimes affected with *granular disease of the kidneys*, which is generally attended by albuminous urine. Dr. Hope regards this state as corresponding to the granular liver just described.⁶

PECULIARITIES OF INTOXICATION FROM SPIRIT.—Different kinds of ardent spirits present some peculiarities in their operation on the system, which will be noticed hereafter (see *Brandy*, *Rum*, *Gin*, *Whiskey* and *Arrack*).

The effects of spirit agree, in a considerable number of circumstances, with those of wine, but present some peculiarities. Spirit more speedily induces excitement, which, however, is of shorter duration, being more rapidly followed by collapse, relaxation, or debility. Death is by no means an infrequent consequence of deep intoxication from spirit. Dram-drinkers suffer usually from loss of appetite, especially in the morning, when they are troubled with vomiting; moreover, they are usually thin, wasted, and emaciated. Wine-bibbers, on the other hand, often enjoy an unimpaired appetite, and are frequently plump or corpulent, plethoric individuals. Liver disease, from intemperance, is said to be peculiar to those who take ardent spirits. Organic disease of the stomach is also a consequence of spirit-drinking.

A somewhat similar distinction holds good between the effects of spirit and those of malt liquors. The latter possess nutritive properties in addition to narcotic

¹ Report of the Resident Physician [Dr. Conolly] of the Hanwell Lunatic Asylum, presented to the Court of Quarter-Sessions at the Middlesex Sessions, 1840.

² London Medical Gazette, vol. xii. p. 484.

³ Pathological Anatomy, art. Atrophy.

⁴ Principles and Illustrations of Morbid Anatomy. Lond. 1834.

⁵ See also Dr. Christison On Granular Degeneration of the Kidneys, p. 110. Edinb. 1839.

⁶ Anatom. Patholog. liv. 12, pl. 1.

powers; hence we frequently observe that the beer toper is a plethoric, corpulent individual.¹

The effects of opium are readily distinguished from those of spirit when insensibility has not come on. The sleep which both these agents commonly induce is not usually preceded, in the case of opium, by delirium, thickness of voice, and peculiar difficulty of articulation. When delirium is produced by this drug (opium), it is rather of the ecstatic kind. "There is more poetry in its visions—more mental aggrandizement—more range of imagination."² But when insensibility is present, the diagnosis is not always easy. The odour of the breath is in these cases an important diagnostic. Moreover, the pupil is usually (though not invariably) dilated by spirit, whereas it is contracted by opium.

MODUS OPERANDI.—That alcohol becomes absorbed, is proved by the fact that it has been found in the blood, in the urine, the breath, the bile, the fluid of the serous membranes, the brain, and the liver.

Tiedemann and Gmelin³ recognized the odour of it in the blood of the splenic vein, though they were unable to detect it in the chyle. A similar observation is reported by Magendie.⁴ Dr. Percy⁵ also found it in the blood of animals to which he administered it. He likewise detected it in the urine and the bile. Moreover, the recognition of the odour of alcoholic liquors in the breath of individuals who have swallowed them, as well as their detection by the smell in the fluid contained in the ventricles of the brain and in the pericardium, prove indisputably that alcohol is absorbed. Dr. Cooke⁶ states, on the authority of Sir A. Carlisle, that in one case the fluid of the ventricles of the brain had the smell, taste, and *inflammability* of gin. Dr. Christison⁷ has questioned the correctness of this observation, on the ground that gin of sufficient strength to take fire could not enter the bloodvessels without coagulating the blood. But the objection appears to me to be groundless; for I find that a small quantity of undiluted commercial gin may be added to white of egg without causing either coagulation or the slightest opacity. Dr. Ogston⁸ has confirmed the testimony of Carlisle, and states that in one case he found about four ounces of fluid in the ventricles, having all the physical qualities of alcohol. Dr. Percy⁹ has recently set the question at rest, and satisfactorily proved the accuracy of the above statements, by his experiments on animals. He appears to think that some peculiar affinity exists between the substance of the brain and the spirit; more especially as, after analyzing a much larger quantity of blood than can possibly exist in the cranium, he could generally obtain much more alcohol from the brain than from this quantity of blood. He was unable to determine whether or not the fluid of the ventricles contained any alcohol. Dr. Percy also detected alcohol in the liver, and has endeavoured to connect this fact with the frequent occurrence of hepatic disease in drunkards.

MORBID APPEARANCES.—On examining the bodies of individuals who have been poisoned by ardent spirits, redness and inflammation of the stomach are sometimes, but not invariably, found. In confirmed drunkards, the mucous membrane of the stomach is often injected and thickened. Congestion of the cerebral vessels, with or without extravasation of blood or effusion of serum, is not unfrequently observed. Traces of spirit may or may not be found in the stomach, according to the rapidity with which death has been produced. The odour of spirit may perhaps be recognized in various parts of the body, especially in the brain and the serous cavities.

¹ Hogarth, in his *Beer Alley* and *Gin Lane*, has well represented the differences between drunkards devoted to malt liquors, and those given to the use of spirit. The first are plump, rubicund, and bloated; the latter are pale, tottering, emaciated, and miserable.

² *The Anatomy of Drunkenness*, by Robert Macnish; p. 63, 2d ed. Glasgow, 1828.

³ *Über die Wege auf welchen Substanzen aus dem Magen ins Blut gelangen*, Heidelberg, 1820.

⁴ *Element. Compend. of Physiology*, by Dr. Milligan, p. 248, 1823.

⁵ *An Experimental Inquiry concerning the presence of Alcohol in the Ventricles of the Brain, after Poisoning with that liquid, together with Experiments illustrative of the Physiological Action of Alcohol*, Lond. 1839.

⁶ *Treatise on Nervous Diseases*, i. 222, Lond. 1820.

⁷ *Edinburgh Medical and Surgical Journal*, vol. xl.

⁸ *Treatise on Poisons*, 3d ed. p. 853

⁹ *Op. supra cit.*

USES.—Spirit of wine is employed both for medicinal and pharmaceutical purposes.

1. MEDICINAL USES.—Spirit is used both internally and externally :—

a. **Internally.**—Spirit of wine is rarely administered internally ; for when ardent spirit is indicated, Brandy, Gin, or Whiskey, is generally employed. The separate uses of each of these will be noticed presently ; at present, therefore, I shall confine myself to some general remarks on the internal employment of spirit. I may observe, however, that Brandy is the ardent spirit usually administered for medicinal purposes ; and, unless otherwise stated, is the spirit referred to in the following observations.

As a *stomachic stimulant*, spirit is employed to relieve spasmodic pains and flatulency, to check vomiting (especially sea-sickness), and to give temporary relief in some cases of indigestion, attended with pain after taking food. As a *stimulant and restorative*, it is given with considerable advantage in the latter stages of fever. As a *powerful excitant*, it is used to support the vital powers, to prevent fainting during a tedious operation, to relieve syncope and languor, and to assist the restoration of patients from a state of suspended animation. In *delirium tremens*, it is not always advisable to leave off the employment of spirituous liquors at once, since the sudden withdrawal of the long-accustomed stimulus may be attended with fatal consequences. In such cases, it is advisable to allow, temporarily, to the patient the moderate use of the particular kind of spirit which he has been in the habit of employing. In *poisoning by foxglove and tobacco*, spirit and ammonia are used to rouse the action of the heart. In *mild cases of diarrhœa*, attended with griping pain, but unaccompanied by any inflammatory symptoms, a small quantity of spirit and water, taken warm, with nutmeg, is often a most efficacious remedy.

β. **Externally.**—Spirit of wine is used externally for several purposes, of which the following are the principal : As a *styptic*, to restrain hemorrhage from weak and relaxed parts. It proves efficacious in two ways ; it coagulates the blood by its chemical influence on the liquid, albumen, and fibrin, and it causes the contraction of the mouths of the bleeding vessels by its stimulant and astringent qualities. Sponge or soft linen, soaked in spirit and water, has been applied to the mouth of the uterus in uterine hemorrhage.¹ Spirit is employed to *harden the cuticle over tender and delicate parts*. Thus, brandy is sometimes applied to the nipples, several weeks before delivery, in order to prevent the production of sore nipples from suckling in individuals predisposed to it. Spirit is also applied to the feet, when the skin is readily blistered by walking. The efficacy of spirit, in hardening the cuticle, depends, in part, on its chemical influence. Spirit gargles have been found serviceable in checking the tendency to inflammation and swelling of the tonsils. As a *stimulant application*, warm rectified spirit has been applied to burned or scalded parts, on the principles laid down for the treatment of these cases by Dr. Kentish.² Properly diluted, spirit has been employed as a wash in various skin diseases, and in ulcers of bed-ridden persons, and as a *collyrium* in chronic ophthalmia. Frictions with rectified spirits have been used in the abdominal region, to promote labour pains ; on the chest, to excite the action of the heart, in fainting or suspended animation ; on the hypogastric region, to stimulate the bladder, when retention of urine depends on inertia, or a paralytic condition of this viscus ; on various parts of the body, to relieve the pain arising from bruises, or to stimulate paralyzed parts.

The *inhalation of the vapour of rectified spirit* has been recommended to relieve the irritation produced by the inspiration of chlorine ; but I have tried the practice on myself without benefit. The readiest mode of effecting it is to drop some spirit on a lump of sugar, and hold this in the mouth during inspiration.

¹ Richter, *Ausführliche Arzneimittellehre*, 3 Bd. S. 256, Berlin, 1828.

² *An Essay on Burns*, Lond. 1798.—*A Second Essay on Burns*, Newcastle, 1800.

Diluted spirit has been used *as an injection for the radical cure of hydrocele*. A mixture of wine and water, however, is commonly employed in this country.

Spirit has been used to form cold lotions. As the efficacy of it depends on its evaporation, it should be applied by means of a single layer of linen, and not by a compress. Evaporating lotions are applied to the head in cephalalgia, in phrenitis, in fever, in poisoning by opium, &c.; to fractures of the extremities; to parts affected with erysipelatous inflammations, &c.

ANTIDOTES.—The first object in the treatment of poisoning by spirituous liquors is to evacuate the contents of the stomach. This is best effected by the stomach-pump; emetics being frequently unsuccessful. Stimulants are then to be employed: the most effectual are the injection of cold water into the ears, cold affusion to the head and neck, warmth to the extremities, when these are cold, and the internal use either of ammonia or of the solution of the acetate of ammonia, both of which agents have been found useful in relieving stupor. The cerebral congestion often requires the cautious employment of local bloodletting and the application of cold to the head. If the patient appear to be dying from paralysis of the respiratory muscles, artificial respiration should be effected; if from closure of the larynx, tracheotomy may be performed.

1. SPIRITUS VINI GALlici [U. S.]; Brandy; ¹ Eau-de-vie.—This is an ardent spirit, obtained by the distillation of wine. Its properties are subject to some variation, arising from different growths of the vine: “the brandies of Languedoc, Bordeaux, Armagnac, Cognac, Aunis, Saintonge, Rochelle, Orleans, Barcelona, Naples, &c., being each recognizable by an experienced dealer.”² The most celebrated of the French brandies are those of Cognac and Armagnac. Genuine brandy has an agreeable, vinous, aromatic odour. Both its flavour and odour, however, are peculiar. *Pale brandy* has a very slight brownish-yellow tint, derived from the cask in which it has been kept. The *high-coloured brandy* usually found in the shops of this country, is artificially coloured (before its arrival in this country) by burnt sugar (caramel); which is said to render the spirit mellow and more palatable.³ Saunders-wood is also stated, by the same authority, to be frequently used as a colouring ingredient. The constituents of brandy are *alcohol, water, volatile oil, a minute portion of acetic acid, a little acetic ether, ænanthic ether, colouring matter, and tannin*. The latter is said to be derived from the cask in which the spirit has been preserved; but I find that the high-coloured brandies react more powerfully on the salts of iron than pale brandy; whence I conclude that some astringent matter has been added to them.

Brandy, when just imported, is usually above proof. I found a sample of pale brandy, in bond, supplied to me by my friend, Mr. Gassiot, to be 1.5 *over proof*; and a coloured brandy 2.2 *over proof*, as indicated by Sikes’s hydrometer. By keeping in the cask, its alcoholic strength is diminished. I am informed that brandy, as usually sold, is 10 *per cent. under proof*. This would give, according to Gutteridge’s table, a sp. gr. of 0.9318. But Soubeiran⁴ states that the sp. gr. of eau-de-vie varies from about 0.902 to 0.941. Now, according to Gilpin’s tables, a spirit having the sp. gr. of 0.93002 is composed of equal parts of alcohol (sp. gr. 0.825) and water. But Mr. Brande states that 100 parts by measure of brandy contain 53.39 parts of alcohol, sp. gr. 0.825. The relative quantities of spirit contained in this and other ardent spirits, in wine, and in beer, have been already mentioned.

British Brandy is extensively manufactured, and sold as foreign brandy. Dr. Ure⁵ gives the following formula for it: “Dilute the pure alcohol to the proof pitch; add to every hundred pounds weight of it, from half a pound to a pound of argol (crude winestone) dissolved in water, a little acetic ether and French-wine vinegar,

¹ Brandy is a contraction for Brandy-wine (*Branntwein*, Germ.), which literally signifies *Burnt-wine* (*Vinum adustum*).

² Ure’s *Dictionary of Arts and Manufactures*, p. 164. Lond. 1839

³ M’Culloch’s *Dictionary of Commerce*.

⁴ *Nouveau Traité de Pharmacie*, t. i. p. 142, 2nde éd.

⁵ *Dictionary of Arts and Manufactures*, p. 165.

some bruised French plums, and flavour-stuff from Cognac; then distil the mixture, with a gentle fire, in an alembic furnished with an agitator. The spirit which comes over may be coloured with nicely burned sugar (caramel) to the desired tint, and roughened in taste with a few drops of tincture of catechu or oak-bark."

Acrid matters (as Grains of Paradise) are sometimes added to brandy to give it an artificial strength; they may be readily detected by evaporation. Sugar, also, may be discovered in the same way. The residue of the evaporation of genuine brandy yields a green colour with the salts of iron, indicating the presence of tannin; and imitation of brandy may be readily made to produce the same effect by the addition of catechu, or some other astringent.

The general effects and uses of brandy are those of alcohol, already described. From the ardent spirits in ordinary use, it is distinguished by its cordial and stomachic properties, and it is, in consequence, the stimulant usually preferred for medicinal purposes.

Burnt Brandy is a popular remedy for diarrhoea.

2. *MISTURA SPIRITUS VINI GALLICI*, L.—(Brandy, Cinnamon Water, of each fʒiv; the yolks of two Eggs; Purified Sugar ʒss; Oil of Cinnamon mʒj. Mix.)—This mixture is an imitation of a well-known compound termed *Egg-flip*.¹ It is an exceedingly valuable stimulant and restorative, and is employed in the latter stages of low fever, and in extreme exhaustion from uterine and other hemorrhages. The dose of it is from fʒss to fʒiss.

3. *SPIRITUS SACCHARI*; *Rum*.—This is an ardent spirit obtained both in the West and East Indies, by distillation from the fermented skimmings of the sugar boilers, the drainings (called *molasses*) of the pots and hogsheds of sugar, the washings of the boilers,² and the lees or spent wash of former distillations, called *dunder*.³ It is imported into this country in puncheons. In some parts of the West India Islands, it is customary to put slices of pine apples in the puncheons of rum; hence the designation, *pine-apple rum*.

The term *Tafia*, or *Taffia*, is applied to a spirit obtained by distillation from the fermented juice of the sugar cane.⁴ It is, therefore, *Cane Spirit* (*Spiritus Succi Sacchari*).

Good rum is transparent and of a brownish tint. Its depth of colour, however, varies considerably. The peculiar flavour of rum depends on *volatile oil*. The quantity of *alcohol* (sp. gr. 0.825) in 100 vols. of rum is, according to Mr. Brande, about 53.68 vols. As sent out, its strength is 10 *per cent. under proof*, in the language of Sikes's hydrometer. *Jamaica rum* is more highly esteemed than the *Leeward Islands rum*.

The general effects and uses of rum are similar to those of alcohol, already described.⁵ It is considered more heating and sudorific than the other kinds of ardent spirit, to which it has been popularly thought preferable in coughs, catarrhs, and rheumatism.

4. *SPIRITUS FRUMENTI COMPOSITUS*; *Compound Corn Spirit*.—The spirit manufactured in the British Islands is usually obtained by distillation from fermented infusions of corn. The ardent spirits known as *Gin*, *Whiskey*, and the various *Compounds*,⁶ are corn spirit differently flavoured.

¹ The terms *Egg-flip*, *Egg-hot*, or simply *Flip*, are applied to a preparation of ale with egg and ardent spirit (see Dr. Kitchener's *Cook's Oracle*).

² *The Civil and Natural History of Jamaica*, by P. Browne, M. D., p. 132, Lond. 1789.

³ *Dunder*, from the Spanish *redundar*, to overflow.

⁴ Merat and De Lens. *Dict. de Mat. Méd.* t. vi. p. 150.

⁵ "They talk of a common experiment here [Jamaica], that any animal's liver put into rum grows soft, and not so in brandy, whence they argue this last less wholesome than that; but their experiment, if true, proves no such thing. I think it may be said to have all the good and bad qualities of brandy, or any fermented or vinous spirit."—Sloane's *Jamaica*, vol. i. p. xxx. Lond. 1707.)

⁶ By spirit dealers. British compounded spirits are denominated *Compounds*, while foreign compounded spirits are called *Liquors*. Both classes of liquors are sweetened spirits.

Gin owes its peculiar flavour to the Juniper, whence it is frequently denominated *Spiritus Juniperi*. It is not allowed to be sent out stronger than 17 per cent. under proof; but it is usually sold to the trade at 22 per cent. under proof. The retail dealer always reduces its strength, and flavours it with sugar. Frequently, also, other additions are made to it. *Gin* possesses the general properties of alcohol. On account of the oil of juniper which it holds in solution, it is more powerfully diuretic than brandy and rum; and hence it is a popular remedy in dropsical and other affections, in which an augmentation of the renal secretion is considered desirable. Moreover, it is frequently used to promote menstruation. It is the ordinary intoxicating spirit of the lower classes in this metropolis. At the London Hospital, gin is frequently administered medicinally, as a substitute for brandy, to patients who have been accustomed to its use.

Whiskey agrees in most of its properties with gin, from which it differs in its peculiar smoky flavour and odour; these it acquires from the malt, which is dried by turf fires. It is the national spirit of Ireland and Scotland.

5. **ARRACK, or RACK.**—This is a spirit obtained in various parts of the East. In Batavia it is procured by distillation from fermented infusions of rice, whence it has been termed *Rice Spirit* (*Spiritus Oryzæ*). In Ceylon,¹ it is obtained by distillation from fermented cocoa-nut toddy (by some some called *Palm wine*).

“Pine apples, steeped in it, impart a most exquisite flavour to the spirit; and, by age, it becomes a delicious liqueur, which is unrivalled in the world for making nectarial punch.” In England, arrack is never employed for medicinal purposes. In its general properties it agrees with the other ardent spirits; but is said to be distinguished by its stimulating and narcotic properties. It is sometimes used in this country to impart an agreeable flavour to *punch*. A mock arrack is made by dissolving twenty grains of benzoic acid in two pounds of rum.

2. **PHARMACEUTICAL USES OF ALCOHOL.**—Alcohol is not employed in the preparation of any officinal substances, but it is a valuable agent in chemical analysis, and is used in determining the purity of certain medicinal substances; as iodine, iodide of potassium, the vegetable alkalies, castor-oil, &c. Rectified and proof spirits are most extensively employed in officinal pharmacy: as in the formation of *Tinctures*, *Spirits*, *Ethers*, *Ethereal Oil*, and *Resinous Extracts*, and in the manufacture of the *Vegetable Alkalies*. Lastly, spirit is added to various preparations to assist in preserving them.

1. **TINCTURÆ, L. D. [U. S.]; Tinctures, E.; Alcoolés.**—These are solutions of vegetable, animal, or mineral, substances, in proof or rectified spirit. They are preparations of substances whose active principles are imperfectly or not at all soluble in water, or whose aqueous solutions readily undergo decomposition.

Some are prepared by *solution* merely; as the *Tinctura Iodini composita*, Ph. L.; *Tinctura Camphoræ*, Ph. Ed.; and *Tinctura Ferri Sesquichloridi*.

Some of the vegetable tinctures are prepared by adding rectified spirit to the expressed juices of plants. These preparations are frequently denominated *preserved vegetable juices*. They have been long in use on the continent. In 1835, Mr.

The following list of Compounds, usually kept at the gin-shops of this metropolis, has been supplied to me by the proprietor of one of these establishments:—

Compounds.	Under Proof.	Compounds.	Under Proof.
Gin	17	Tent	64
Gin	22	Aniseed	“
Mint (<i>Peppermint</i>) . .	64	Caraway	“
Cloves	“	Lovage	“
Bitters	“	Usquebaugh (X)	“
Raspberry	“	Rum Shrub	“
Noyeau	“	Orange Cordial (X) . . .	“
Cinnamon	“	Citron do. (X)	“

“The above are permitted to us at the strengths named; but, in point of fact, are much nearer approaching 80 U. P.—Those marked thus (X) are seldom asked for.”

¹ *The Coco-Nut Palm, its Uses and Cultivation*, by J. W. Bennett, Esq. Lond. 1836.

Squire¹ commenced their manufacture. More recently, Mr. Bentley² has directed the attention of the profession to them.

Mr. Squire states that, on an average, the juice of the young plant just coming into flower will yield only two thirds of the amount of extract which is obtained from the same quantity of juice from the matured plant ("when more than half the flowers are fully blown"), and the strength of the product is also inferior. He also asserts³ that the leaves only should be used; and in the case of biennial plants, those of the second year's growth should exclusively be employed.⁴

The mode of obtaining these preparations is as follows: The leaves being bruised in a marble mortar, are placed in a powerful press. The expressed juice is allowed to stand for twenty-four hours, by which a considerable quantity of feculent matter is deposited. Rectified spirit [56 over proof] is then added, in the proportion of four fluidounces to every sixteen fluidounces of the juice, which is quite sufficient to render the preservation complete, and throw down any mucilage which may be mechanically suspended. After standing twenty-four hours, the liquor is to be filtered.⁵

Mr. Squire employs one measure of spirit to two measures of juice.

These preserved expressed juices are superior preparations to the tinctures prepared by digestion from the same parts of either fresh or dried plants. In some cases (*e. g.* Aconite), tinctures prepared with rectified spirit from the dried roots, by digestion, are greatly superior in activity to the preserved juices of the leaves.

The ordinary method of preparing tinctures is by *maceration* or *digestion*.

"Tinctures are usually made by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for seven days or upwards in proof spirit or rectified spirit, straining the solution through linen or calico, and finally expressing the residuum strongly to obtain what fluid is still retained in the mass."—*Ph. E.*

"All Tinctures should be prepared in stoppered glass vessels, and frequently shaken during maceration."—*Ph. Lond.*

The tinctures which are made with resinous substances cannot in general be well prepared in any other way than by digestion. This remark applies to *Tinctura Aloes*, *Tinctura Assafetide*, *Tinctura Benzoini composita*, *Tinctura Guaiaci*, and *Tinctura Balsami Tolutani*. Another and more expeditious method of preparing tinctures is by *percolation* or *lixivation* (*procédé ou méthode de déplacement*); and which is also applicable to the preparation of ethereal, as well as alcoholic, tinctures, and of infusions. The principle of this method has been adopted by the Scotch brewers; the process being called by them *sparging*. It has also been used in the preparation of coffee. It was first employed for pharmaceutical purposes by Boullay.⁶ In the preparation of tinctures, its professed advantages are expedition, economy, and uniformity of strength. But it is more troublesome, requires more skill and attention, and is not equally applicable to all substances. It answers best for those tinctures made with woody and fibrous parts, as roots, barks, woods, leaves, fruits, seeds, and insects. The Tinctures of Catechu and Myrrh may also be prepared in this way. The *Edinburgh College* offers the following remarks on this mode of preparation:—

"A much superior method, however, has been lately introduced, which answers well for most tinctures; namely, the method of displacement by percolation. According to this process, the solid materials, usually in coarse or moderately fine powder, are moistened with a sufficiency of the solvent to form a thick pulp. In twelve hours, or frequently without any delay, the mass is put into a cylinder of glass, porcelain, or tinned iron, open at both ends, but obstructed at the lower end by a piece of calico or linen, tied tightly over it as a filter; and the pulp being packed by pressure, varying as to degree with various articles, the remainder of the solvent is poured into the upper part of the cylinder, and allowed gradually to percolate. In order to obtain the portion of the fluid which is kept in the residuum, an additional quantity of the solvent is poured into the cylinder, until the tincture, which has passed through, equals in amount the spirit originally prescribed; and the spirit employed for this purpose is then recovered for the most part by pouring over the residuum as much water as there is of spirit retained in it, which

¹ *Pharmaceutical Transactions*, No. iii. p. 91, Sept. 1841.

² *On the Best Method of obtaining the more powerful Vegetable Preparations for Medicinal Use*.

³ *Op. supra cit.*

⁴ See the article *Hyoscyamus* for an account of the relative quantities of juice and extract yielded by the leaves and stalks.

⁵ Bentley, *op. supra cit.*

⁶ *Journal de Pharmacie*, t. xix. p. 393.

may be easily known by an obvious calculation in each case. The method by percolation, where applicable, will be found much more convenient and expeditious than the mode hitherto commonly followed, and it exhausts the solid materials in general much more completely. As considerable practice, however, is required for managing the details in different cases, more especially in regard to the degree of firmness with which they are to be packed in the cylinder, we have thought it right to direct that the method of maceration may be followed as an alternative. But the method of percolation is now preferred by all who have made sufficient trial of it to apply it correctly."

The percolator is best made of tin plate or zinc. A simple tube (of glass, porcelain, or tinned iron), as stated by the Edinburgh College, answers for an extemporaneous percolator. It is fitted into the mouth of a wide-mouthed bottle by means of a cork (Fig. 392), in which is a small aperture to allow the escape of air. One of the most convenient percolators is that proposed by Boullay. It is a simple cylinder of equal diameter, and terminating inferiorly in a cone or funnel. Mr. Deane's percolator¹ (Fig. 393) is a modification of this; its lower end, c d, has a smaller circumference than its upper one, A B; is flat, and communicates with a tube, to which a stopcock is fitted. Soubeiran² has adapted to Boullay's percolator a tin receiver, to which is fitted, at the most depending part, a stopcock by which the tincture may be drawn off (Fig. 394).

Fig. 392.



Fig. 393.

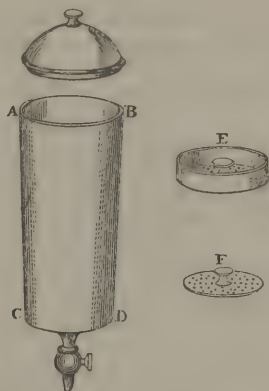
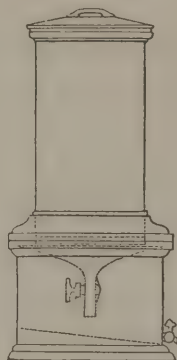


Fig. 394.

*Tincture Percolators.*

The size of the percolator must, of course, vary according to circumstances. The smallest may be half an inch in diameter, and four inches long. Large ones are six inches in diameter, and eighteen inches long. They should be furnished with two diaphragms (perforated metallic disks, Fig. 393, E, F), between which the ingredients are placed. When small percolators are used, a little cotton-wool, or even tow, may be substituted for the lower diaphragm—or a piece of calico or linen may be tied over the end of the tube, as directed by the Edinburgh College. The lower extremity of the percolator should be furnished with a stopcock (see Figs. 393 and 394), for regulating the discharge of the fluid.

Considerable skill and experience are required in packing the ingredients. Indeed, the principal art of percolating has reference to this part of the process. Substances, as Rhubarb and Gentian, which yield a large quantity of mucilage, and are to be acted on by water, must be employed in the form of a very coarse powder, and should be placed loosely in the percolator, in order to allow them to swell. With alcohol or ether, however, the tissues swell less, the mucilaginous matter is not dissolved, and the percolation is readily effected even with a finer powder and closer packing.

¹ *Pharmaceutical Transactions*, part ii.² *Nouveau Traité de Pharmacie*, t. i. p. iii. 2nde éd.

Boullay imagined that one liquid may be employed to displace another liquid, without the two liquids becoming mixed; hence he called the process the *displacement method*. The Edinburgh College, I presume, has adopted his opinion, since it directs the tincture to be displaced by spirit, and the spirit by water. But (Guilliermond¹ has shown that this displacement cannot be effected without a certain degree of mixture.²

2. SPIRITUS, L. [U. S.]; *Spirits*, E.; *Essentia*, D.—These are alcoholic solutions of volatile substances (usually of a vegetable nature) sometimes obtained by distillation. Some of them are prepared with rectified spirit (e. g. *Spiritus Rosmarini*), some with alcohol, as *Essentia Fœniculi*, D. The spirits which owe their peculiar flavour and odour to volatile oil are now prepared according to the directions of the *London College*, by dissolving the oil in spirit, without the aid of distillation; and, for all therapeutical purposes, they are equally effective.

301. ÆTHER SULPHURICUS, E. D.—SULPHURIC ETHER.

[Æther, L. U. S.]

HISTORY AND SYNONYMES.—This liquid is said to have been known to Raymond Lully,³ who lived in the 13th century; and to Basil Valentine,⁴ in the 15th century. In 1540, Valerius Cordus⁵ described the method of making it. He termed it *Oleum Vitrioli dulce*. The Germans call it *Vitriolic Naphtha* (*Naphtha Vitrioli*).

NATURAL HISTORY.—It is always an artificial product.

PREPARATION.—The Edinburgh and Dublin Colleges give directions for the preparation of sulphuric ether. In the Pharmacopœia of the London College, Ether is placed among the articles of the *Materia Medica*.

The *London College* formerly ordered of Rectified Spirit ℥ij; Sulphuric Acid ℥ij; Carbonate of Potash, previously ignited, ℥j; pour two pounds of the spirit into a glass retort, add the acid to it, and mix. Afterwards place it on sand, and raise the heat so that the liquor may quickly boil, and the Ether pass into a receiving vessel cooled with ice or water. Let the liquor distil until some heavier portion begins to pass over. To the liquor which remains in the retort, after the heat has subsided, pour the remainder of the spirit, that ether may distil in the same manner. Mix the distilled liquors, then pour off the supernatant portion, and add to it the Carbonate of Potash, shaking them frequently during an hour. Lastly, let the ether distil from a large retort, and be kept in a stoppered vessel.

The directions of the *Edinburgh College* are as follows: "Take of Rectified Spirit f℥℥; Sulphuric Acid f℥x. Pour twelve fluidounces of the spirit gently over the acid contained in an open vessel, and then stir them together briskly and thoroughly. Transfer the mixture immediately into a glass matrass connected with a refrigerator, and raise the heat quickly to about 280°. As soon as the ethereal fluid begins to distil over, supply fresh spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal that of the fluid which distils over. This is best accomplished by connecting one end of the tube with a graduated vessel containing the spirit, passing the other end through a cork fitted in the matrass, and having a stopcock on the tube to regulate the discharge. When forty-two ounces have distilled over, and the whole spirit has been added, the process may be stopped. Agitate the impure ether with sixteen fluidounces of a saturated solution of muriate of lime, containing about half an ounce of lime recently slaked. When all odour of sulphuric acid has been thus removed, pour off the supernatant liquor, and distil it with a very gentle heat, so long as the liquid which passed over has a density not above 0.735. More ether of the same strength is then to be obtained from the solution of muriate of lime. From the residuum of both distillations, a weaker ether may be obtained in small quantity, which must be rectified by distilling it gently again."

The *Dublin College* directs Sulphuric Ether to be thus prepared: "Take of Rectified Spirit three pints; Oil of Vitriol of commerce eight fluidounces; Fresh burned Lime, in fine powder, one ounce; mix the acid and ten ounces of the spirit in a glass matrass, capable of holding a

¹ *Journal de Pharmacie*, t. xxi. p. 349.

² For farther details respecting percolation, consult, besides the memoirs already quoted, Dausse, *Mémoire sur la préparation de tous les extraits pharmaceutiques par la méthode de déplacement*. Paris, 1836.

³ Dulk, *Die Preussische Pharmacopœe übers. und erläutert*, 2 Th. S. 201, 2 Aufl. Leipz. 1830.

⁴ *Ibid.*

⁵ Thomson, *System of Chemistry*, vol. ii. p. 296, 7th ed. 1831.

quart at least, and, without allowing the mixture to cool, connect the matrass with a Liebig's condenser, and, applying a sufficient heat to maintain the liquid in a brisk ebullition, commence the distillation. As it proceeds, admit gradually, through a glass tube traversing the cork of the matrass, the remainder of the spirit, regulating its influx so that the boiling liquid shall maintain a constant level; and, when the entire of it has been introduced, continue the application of the heat until the contents of the matrass become black, and show a tendency to froth over. (The tube through which the spirit enters should dip by its lower extremity, where its diameter is contracted, at least half an inch beneath the surface of the liquid in the matrass; and the eduction pipe of the reservoir for the spirit, with which the exterior extremity of the glass tube is connected, should be furnished with a stopcock, to regulate the descent of the spirit. This reservoir also should be placed at least three feet above the level of the boiling liquid.) The crude ether thus obtained is to be agitated with the pulverized quicklime, and then rectified, the distillation being continued as long as the product, on being well shaken, continues to have a specific gravity lower than 750. The resulting liquid should be preserved in a cool place in accurately stopped bottles. A fresh reservoir being attached to the farther end of the condenser, and the distillation resumed, a product will be obtained which may be substituted for rectified spirit in a subsequent ether process."

THEORY OF ETHERIFICATION.—In order to convert one equivalent or 46 parts of alcohol into one equivalent or 37 parts of ether, we must abstract one equivalent or 9 parts of water.

	Carbon.	Hydrogen.	Oxygen.
1 equivalent Alcohol is composed of . . .	4 eq.	6 eq.	2 eq.
Abstract 1 equivalent Water composed of	0 eq.	1 eq.	<u>1 eq.</u>
1 equivalent Ether	4 eq.	5 eq.	1 eq.

[Or, the change may be thus represented: $C^4H^6O^2 = HO + C^4H^5O$. Assuming that ethyle is represented by C^4H^5 , then ether is an oxide of this compound radical AeO , and alcohol is a hydrated oxide, containing in addition the elements of one equivalent of water.—ED.]

But, though the change thus far appears very simple, there are some accessory reactions which make the theory of etherification exceedingly complicated, and about the precise nature of which chemists are not quite agreed.

That the sole or efficient cause of the conversion of alcohol into ether is not the mere abstraction of water, by the affinity of the sulphuric acid for that liquid, is proved by various circumstances, of which the following are some:—¹

- a. Water may be abstracted from alcohol by alkalies and chloride of calcium, yet nothing like ether is the result.
- β. Water passes over, during the whole process, along with the ether, with which the acid ought to combine in preference to dehydrating the alcohol.
- γ. Ether is not produced by the action of anhydrous sulphuric acid on alcohol.
- δ. Ether is never produced except by the aid of heat.
- ε. When the oil of vitriol is mixed with rectified spirit, the saturating power of the acid is diminished.

When oil of vitriol is added to rectified spirit, a new compound is formed, which contains, besides the elements of sulphuric acid, carbon, hydrogen, and oxygen. As this new compound reddens litmus, and forms salts with bases, it has been regarded as an acid (*Sulpho-vinic acid*; ² *Ethereo-sulphuric acid*).³ But as the sulphuric acid, by its union with the elements of the alcohol, has lost half its saturating power, the new compound is rather to be regarded as a supersalt (*bisulphate of the oxide of ethyle*),⁴ combined with water; or as a double salt composed of sulphate of the oxide of ethyle and sulphate of water. Carbo-hydrogen is the basic constituent of this salt, which, by the action of heat, is resolved into ether, sulphuric acid, and water. On the ethyle hypothesis, so ably advocated by Liebig, the following is an explanation of the changes attending the formation of ether:—

Alcohol is regarded as a hydrate of the oxide of ethyle, and its equivalent is assumed to be 46. On the addition of oil of vitriol, two equivalents or 80 parts of anhydrous sulphuric acid combine with one equivalent or 37 parts of oxide of

¹ Brande, *Manual of Chemistry*, 5th edit. p. 1284, 1841.

² Hennel. *Phil. Trans.* 1826 and 1828.

³ Liebig, in the *Handwörterbuch der reinen und angewandten Chemie*, von Dr. J. Liebig und Dr. T. C. Poggendorf, Bd. i. S. 114, Braunschweig, 1837.

⁴ Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 837 et seq. 1840.

ethyle (*ether*), contained in the alcohol, and form one equivalent or 117 parts of bisulphate of oxide of ethyle (*bisulphate of ether*). The water of the alcohol and of the oil of vitriol unites with the bisulphate. By the heat which is subsequently applied to the mixture, the hydrated bisulphate is resolved into ether, water, and sulphuric acid.

"If we consider each particle of the [hydrated] bisulphate of oxide of ethyle as composed of ether [oxide of ethyle], anhydrous sulphuric acid, and water, it is clear that the anhydrous acid, at the moment of its separation from the ether, must seize on all water, free or combined, in the vicinity of the ether. Thus, at the moment the ether becomes free, the anhydrous acid, also set free, prevents it from uniting with water to form alcohol. But when the gaseous ether passes through the undecomposed hydrated bisulphate of oxide of ethyle, a certain proportion of the water of that compound must evaporate in the dry gas; and in these circumstances the ether and water do not combine together. The surface of the effervescing liquid has the temperature at which [hydrated] bisulphate of oxide of ethyle is decomposed; but at this temperature, 284° , the water of that compound is gaseous. There are thus produced, simultaneously, water in the gaseous form by evaporation, and ether, also gaseous, by decomposition; which, as both are in the nascent state, unite to form alcohol. Thus the alcohol, always observed to distil over with the ether, is derived from the surface; and the ether and water, which distil over, proceed from the decomposition in the interior of the liquid. This explains why no ether is obtained when the liquid is not in brisk ebullition, no matter how high the temperature may be; it explains farther, why more alcohol is obtained when a current of dry air passes through the liquid, since in that case the same decomposition goes on in the interior of the liquid as generally occurs at the surface."¹

During the distillation of ether, the relative proportions of the ingredients are constantly varying; for the absolute quantity of hydrated bisulphate of ethyle is continually diminishing, and thereby the relative quantity of oil of vitriol is increasing. In consequence of this, the boiling point of the liquid gradually rises. When it arrives at about 320° , new reactions take place between the oxide of ethyle and the sulphuric acid. The principal products of these reactions are sulphurous acid, olefiant gas, water, and carbon; but these are not the only products. In certain proportions of the ingredients, acetic acid [$C^4H^3O^2$] is formed. "With a great excess of [sulphuric] acid, traces of formic acid [$C^2H^3O^2$] and carbonic oxide are produced. As long as olefiant gas comes off, carbonic acid cannot be detected. During this decomposition, sulphurous acid and olefiant gas are given off in equal volumes." "Carbon and water are the elements of acetic acid, the formation of which must diminish the quantity of carbon in the residue. By the action of the sulphuric acid in excess on acetic acid, formic acid and sulphurous acid are formed; and by the action of the sulphuric acid in excess on formic acid, carbonic oxide gas is produced."² "It is probable that, in this decomposition, the elements of sulphuric acid and of ether first arrange themselves so as to form ethionic [$4SO^3, C^4H^5O$] or isethionic [$S^2O^5, C^4H^5O^2 + aq.$] acids." A small quantity of Light Oil of Wine is also produced. In the directions for the preparation of ether given by the London College, the process is directed to be stopped when some "heavier portion" begins to pass over. This heavier liquid is an aqueous solution of sulphurous acid. On the small scale, ether may be readily made in a tubulated glass retort, connected by Liebig's condensing tube with a cooled glass receiver. At Apothecaries' Hall, London, it is made in a leaden still, having a pewter head connected by about six feet of tin pipe with a very spacious condensing worm, duly cooled by a current of water; the receivers are of pewter with glass lids, and have a side tube to connect them with the delivering end of the worm-pipe. The still is heated by high-pressure steam carried through it in a contorted leaden pipe. A tube enters the upper part of the still for the purpose of suffering alcohol gradually to run into the acid.³

Mitscherlich⁴ has shown how a given quantity of oil of vitriol may be made to convert an unlimited quantity of alcohol into ether; the whole of the alcohol

¹ Liebig, in *Turner's Elements of Chemistry*, 7th edit. p. 841.

² Brande's *Manual of Chemistry*, 5th edit. p. 1275, 1-41.

⁴ *Lehrbuch der Chemie*, Band. i. S. 98, 2te Aufl. Berlin, 1833.

³ Liebig, *op. supra cit.*

which enters the retort passing off as ether and water. As, however, ether is usually prepared from hydrated alcohol (rectified spirit), the superfluous water gradually dilutes the acid until ultimately it becomes too dilute to effect the conversion of alcohol into ether. The process of the Edinburgh Pharmacopœia is an imitation of Mitscherlich's principle. [According to this chemist, ether is produced only so long as the liquid has a temperature between 284° and 302° .] The rectification of ether is intended to free it from alcohol, water, sulphurous acid, and oil of wine. It may be affected by the addition of carbonate of potash and redistillation. In order to separate alcohol from ether, the readiest method is to shake the ether with twice its bulk of water; then pour it off, and remove the water, which the washed ether has dissolved, by adding some fresh burned lime, or fused chloride of calcium, and distilling the ether a second time.

PROPERTIES.—At ordinary temperatures, ether is a colourless, very limpid liquid, having a penetrating, peculiar, though somewhat fragrant odour; a hot, pungent taste; and a high refractive power. It is a bad conductor of electricity. According to Liebig, it may be frozen at 46° below zero. The sp. gr. of pure ether at 68° F. is, according to Dumas and Boullay, 0.713. The ether of the shops contains a little alcohol, and its sp. gr. varies from 0.733 to 0.765; in the London Pharmacopœia, its sp. gr. at 62° F. is fixed at 0.750. Ether is extremely volatile: when of sp. gr. 0.720, its boiling point (the mercury in the barometer standing at 30 inches) is about 98° F. In a vacuum, it boils at 40° F. below zero. The evaporation of ether causes intense cold; [and the greatest degree of cold yet produced = -166° , has resulted from the admixture of ether with solid carbonic acid.—ED.] The sp. gr. of ether-vapour was found, by Gay-Lussac, to be 2.586. Pure and recently prepared ether possesses neither acid nor alkaline properties; but, by exposure to air and light, it absorbs oxygen, by which acetic acid and water are produced. The acetic acid is not immediately observed, because it combines with some undecomposed ether to form acetic ether. Ether is very combustible; it burns in atmospheric air with a yellowish-white flame, and forms carbonic acid and water. Its vapour, mixed with oxygen or atmospheric air, forms a violently explosive mixture. One volume of ether-vapour consumes, in burning, six volumes of oxygen gas; the products are, four volumes of carbonic acid, and five volumes of aqueous vapour. By the slow combustion of ether vapour, by means of a coil of platinum wire, acetic, formic, and lampic [aldehydic] acids are produced.

Ether is sparingly soluble in water; nine volumes of the latter dissolve one of the former. Ether which has been washed with water contains a small portion of this liquid. Alcohol dissolves ether in all proportions. Ether abstracts bichloride of mercury, terchloride of gold, bichloride of platinum, and the sesquichloride of iron, from their watery solutions. It readily dissolves bromine and iodine; but the solutions, by keeping, undergo decomposition. It sparingly dissolves sulphur and phosphorus; the ethereal solution of phosphorus is luminous in the dark when poured on hot water. It dissolves the volatile oils, most of the fatty and resinous substances, some of the vegetable alkalies, urea, osmazome, gun-cotton (forming *collodion*), and caoutchouc.

CHARACTERISTICS.—Sulphuric ether may be recognized by its combustibility, its yellowish-white flame, its volatility, its peculiar odour and taste, its complete solubility in alcohol, and its sparing solubility in water; in consequence of which, when mixed with water and agitated in a phial, the mixture speedily separates, on standing, into two layers. It dissolves most resins; the solutions, evaporated on the surface of water, leave a resinous film.

COMPOSITION.—The following is the elementary composition of ether:—

	Atoms.	Eq. Wt.	Per Cent.	Dumas & Boullay.
Carbon	4	24	64.87	65.05
Hydrogen . . .	5	5	13.51	13.85
Oxygen	1	8	21.62	21.24
Ether	1	37	100.00	100.14

Chemists are not agreed as to the manner in which these elements are associated. Ether has been considered, at different times, as a *dihydrate of olefiant gas*; a *hydrate of etherine*, or as the *oxide of ethyle* (ethereum).

2 eq. olefiant gas	28	1 eq. etherine	28	1 eq. ethyle	29
1 eq. water	9	1 eq. water	9	1 eq. oxygen	8
1 eq. Dihydrate of Olefiant Gas	37	1 eq. Hydrate of Etherine	37	1 eq. Oxide of Ethyle .	37

In this table, olefiant gas is regarded as $\frac{2}{3}$ carbo-hydrogen, etherine as a $\frac{1}{4}$ carbo hydrogen, and ethyle as $\frac{1}{3}$ carbo-hydrogen.

[Dr. Frankland has succeeded in isolating the compound radical ethyle. He procured it by the action of zinc at high temperatures upon iodide of ethyle. He describes it as a colourless and inflammable gas, of a specific gravity = 2.0039, incondensable to the liquid state at zero, but capable of being converted under a pressure of 2.25 atmospheres, at 37.5°, into a colourless transparent liquid.—Ed.]

PURITY.—The ether of commerce is usually contaminated with small quantities of either spirit or water, or both. These augment its sp. gr., but do not much affect its medicinal properties. The London College states that its sp. gr. should not exceed 0.750; but this is too high. The Edinburgh College fixes it at 0.735, or under. I think 0.740 would be sufficiently low. Ether which contains no alcohol does not coagulate the serum of the blood. Pure ether does not redden litmus; but the ether of the shops usually does so slightly, either from being imperfectly prepared, or from having been too long kept. Ten fluidounces of water should not dissolve more than one fluidounce of ether, and the solution should be quite transparent. It should speedily and totally evaporate in the air. It should not become milky when mixed with water. "When agitated in a minim measure, with half its volume of concentrated solution of muriate of lime, its volume is not lessened," *Ph. Ed.*

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Ether, like alcohol, acts as a powerful and rapid poison to plants.

β. On Animals.—The effects of it on dogs have been determined by Orfila,² who found that half an ounce introduced into the stomach, and the œsophagus tied, caused attempts to vomit, diminished muscular power, insensibility, and death in three hours. Three drachms and a half, injected into the cellular tissue of the thigh, caused death on the fourth day. Jäger³ found that half an ounce of ether acted as a fatal poison to a crane; at the end of forty-eight hours, its odour could be readily detected in the body. He made similar experiments with pigeons and ducks. One of the last-mentioned animals took altogether an ounce of ether, yet was not dead at the end of twenty-four hours.

γ. On Man.—The operation of ether is analogous to that of alcohol, but is much more rapid and transient. *Swallowed in moderate doses*, it makes a powerful impression on the mouth, throat and stomach; allays spasm, and relieves flatulence; but, according to some observers, it augments neither the heat of the body nor the frequency of the pulse.⁴ Its first effects on the cerebral functions are those of an excitant, but the subsequent ones are those of a depressing agent. *In somewhat larger doses*, it produces intoxication like that caused by alcohol. *In excessive doses*, it occasions nausea, a copious flow of saliva, giddiness, and stupefaction.

The long and habitual use of ether diminishes the effect of this substance over the system, and, therefore, the dose must be proportionately increased. Dr. Christison mentions the case of an old gentleman who consumed sixteen ounces every eight or ten days, and had been in the habit of doing so for many years. Yet, with the exception of an asthma, for which he took the ether, he enjoyed tolerable health. The chemist, Bucquet, who died of scirrhus of the colon, with inflamma-

¹ See *Journal of Chemical Society*, vol. ii.

² W hmer, in *Die Wirkung*, &c.

³ Schwilgué, *Traité de Mat. Méd.* 1815; also Trousseau and Pidoux, *Traité de Thérap.* 1836.

⁴ *Toxicol. Gén.*

tion of the stomach and of the intestines generally, took, before his death, a pint of ether daily, to alleviate his excruciating pains.¹

When the vapour of ether, sufficiently diluted with atmospheric air, is *inhaled*, it causes irritation about the epiglottis, a sensation of fulness in the head, and effects analogous to those caused by the protoxide of nitrogen; moreover, persons peculiarly susceptible of the action of the one, are also powerfully affected by the other.² If the air be too strongly impregnated with ether, stupefaction ensues. In one case, this state continued, with occasional periods of intermission, for more than thirty hours; for many days the pulse was so much lowered that considerable fears were entertained for the safety of the patient (*op. cit.*). In another case, an apoplectic condition, which continued for some hours, was produced. [The anæsthetic properties of this vapour are well known. In surgical operations, it has been much used for the purpose of destroying sensibility; but preference is now given to the vapour of chloroform.—ED.]

MODUS OPERANDI.—When ether is swallowed, it is rapidly absorbed, and subsequently thrown out of the system by the pulmonary exhalants. Magendie³ says, that ether introduced into the cavity of the peritoneum is discoverable in the expired air by its odour. Thrown into the cavity of the pleura, it produces speedy death, and its odour is very obvious when we approach the mouth of the animal.⁴ In the case of a man poisoned by laudanum, and to whom, before death, half an ounce of spirit of sulphuric ether was given, the ether was detected by its odour in the brain.⁵

USES.—Ether is employed both medicinally and for pharmaceutical purposes.

1. MEDICINAL USES. *a. Internal.*—Ether is principally valuable as a speedy and powerful agent in spasmodic and painful affections not dependent on local vascular excitement, and which are accompanied by a pale cold skin, and a small feeble pulse. If administered during a paroxysm of spasmodic asthma, it generally gives relief, but has no tendency to prevent the recurrence of attacks. In cramp of the stomach, singultus, and flatulent colic, its happy effects are well established.⁶ It is sometimes highly advantageous in a paroxysm of angina pectoris. During the passage of urinary or biliary calculi, it may be used as a substitute for, or in combination with, opium, to overcome the spasm of the ducts or tubes through which the calculus is passing. In the latter stages of continued fever, ether is sometimes admissible. It is employed to relieve the subsultus tendinum and hiccup. Desbois de Rochefort⁷ administered it in intermittent fevers. He gave it about half an hour before the expected paroxysm; it acted as a mild diaphoretic, and prevented the recurrence of the attack. Headache of the kind popularly called nervous, that is, unconnected with vascular excitement, is sometimes speedily relieved by ether. I have found it beneficial principally in females of delicate habits. In such it occasionally gives immediate relief, even when the throbbing of the temporal vessels and suffusion of the eyes (symptoms which usually contraindicate the employment of ether) would seem to show the existence of excitement of the cerebral vessels.

In flatulence of the stomach it may be taken in combination with some aromatic water. Against sea-sickness it should be swallowed in a glass of white wine. Durante⁸ recommends a mixture of three parts ether, and two oil of turpentine, as a solvent for biliary calculi. Bourdier⁹ employed ether to expel tape-worm. He administered it, by the stomach and rectum, in an infusion of male fern, giving a dose of castor-oil an hour after. In faintness and lowness of spirits, it is a popular remedy. In poisoning by hemlock and mushrooms, it has been employed.¹⁰ In asphyxia it has been used with benefit.

¹ Mèrat and De Lens, *Dict. Mat. Méd.*

² *Journal of Science*, iv. 159.

³ *Elem. Compend. Physiol.* by Milligan.

⁴ *Lectures on the Tissues*, in *Lancet*, Nov. 22, 1831.

⁵ *Lancet* for 1836—7, vol. i. p. 271.

⁶ On the Effects of Ether in Spasmodic Affections of the Stomach, and in Intermittents. See *Medical Facts and Observations*, vol. v. Lond.

⁷ *Cours Élém. de Matière Médicale*, Paris, 1789.

⁸ *Observ. sur l'Efficacité du Mélange d'Ether sulphurique et d'huile volatile du Téréb. dans Coliques hépatiq. produites par des Pierres Biliaires*, Strasburg, 1790.

⁹ *Mém. de la Société de M. d.*

¹⁰ J. Frank, *Toxicologie*, S. 70, 103.

The vapour of ether is inhaled in spasmodic asthma, chronic catarrh, and dyspnoea, whooping-cough, and to relieve the effects caused by the accidental inhalation of chlorine gas. It may be used by dropping some ether in hot water, and inspiring the vapour mixed with steam; or it may be dropped on sugar, which is to be held in the mouth. The inhalation of the vapour of the ethereal tincture of hemlock is occasionally useful in relieving spasmodic affections of the respiratory organs, and has been recommended in phthisical cases.

β. *External*.—The principal external use of ether is to produce cold by its speedy evaporation. Thus, in strangulated hernia, it may be dropped on the tumour and allowed to evaporate freely: by this means, a considerable degree of cold is produced, and, in consequence, the bulk of the part diminished, whereby the reduction of the hernia is facilitated. Dropped on the forehead, or applied by means of a piece of thin muslin, ether diminishes vascular excitement, by the cold produced from its evaporation, and is exceedingly efficacious in headache and inflammatory conditions of the brain. In burns and scalds, it may also be employed as a refrigerant. If its evaporation be stopped or checked, as by covering it with a compress, it acts as a local irritant, causing rubefaction, and, by long-continued application, vesication. It is used with friction as a local stimulant.

2. PHARMACEUTICAL USES.—Ether is employed in the preparation of the Compound Spirit of Sulphuric Ether. Ether, or its alcoholic solution, is also used to extract the active principles of certain drugs, as of Lobelia, Aloes, Musk, &c. The solutions are called Ethereal Tinctures (*Tincturæ Etherææ*), or by the French pharmacologists *Ethéroles*. These may be conveniently prepared by percolation. Ether is of assistance in determining the purity of some medicinal substances, as of Aconitina and Veratria, which are very soluble in it. It is employed in toxicological researches to remove Bichloride of Mercury from organic mixtures. [A solution of gun-cotton or xyloidine in ether is well known and extensively employed in pharmacy under the name of *Collodion*.—ED.]

ADMINISTRATION.—It may be given in doses of from fʒss to fʒij: a teaspoonful is the ordinary quantity. This dose may be repeated at short intervals. It is usually exhibited in some aromatic water, and frequently in combination with other antispasmodics and stimulants, as ammonia or valerian. "It may be perfectly incorporated with water, or any aqueous mixture, by rubbing it up with spermaceti, employed in the proportion of two grains for each fluidrachm of the ether."¹

ANTIDOTES.—In cases of poisoning by ether, the same treatment is to be adopted as before recommended in cases of poisoning by alcohol.

1. SPIRITUS ÆTHERIS SULPHURICI, E.; *Spirit of Sulphuric Ether*.—(Sulphuric Ether Oj; Rectified Spirit Oij. Mix them. The density of this preparation ought to be 0.809. "It does not affect litmus paper, or render water muddy; when agitated with twice its volume of a concentrated solution of muriate of lime, 28 per cent. of ether separates by rest.")—Its medicinal properties are similar to, though somewhat less powerful than those of ether, over which it has the advantage of being miscible with water in all proportions. The dose of it is fʒj to fʒiij, mixed with some diluent. It is used in the preparation of the *Tinctura Lobeliæ æthereæ*, E.

2. SPIRITUS ÆTHERIS COMPOSITUS, L. [U. S.]; *Compound Spirit of Sulphuric Ether*.—(Sulphuric Ether fʒviij; Rectified Spirit fʒxvj; Ethereal Oil fʒiij. Mix.)—This preparation is commonly called *Hoffmann's Mineral Anodyne Liquor* (*Liquor anodynus mineralis Hoffmanni*); being made in imitation of a preparation described by Hoffmann,² which it is said he was taught by an apothecary of the name of Martmeier.³ This preparation is sometimes employed as an adjunct to laudanum, to prevent the nausea which the latter excites in certain habits. Its dose is from fʒss to fʒij in any proper vehicle.

¹ *United States Dispensatory*, 3d edit. p. 727, Philadelphia, 1836.

² *De Acido Vitrioli Vinoso*, 1732. Fr. Hoffmanni *Operum omnium Supplementum*, p. 855, Geneva, 1751.

³ Voigtells, *Vollständiges System der Arzneimittellehre*, Bd. ii. 3tte Abt. S. 32, Leipzig, 1817.

302. OLEUM ÆTHEREUM, L.—ETHEREAL OIL.

(Spiritus ætheris oleosus, D.)

HISTORY AND SYNONYMES.—This liquid is commonly termed *heavy oil of wine*, or simply *oil of wine*. Dumas¹ says it was known to Paracelsus, who designated it *sweet oil of vitriol*. Modern writers have given it various appellations, founded on its supposed composition. Thus, according to Mr. Hennell,² it is a *sulphate of hydrocarbon*; Dumas³ calls it *sulphatic ether*; others, a *double sulphate of ether and hydrocarbon*; while Liebig⁴ terms it *sulphate of oxide of ethyle and Etherole*.⁵

PREPARATION.—The following directions for procuring it are given in the *London Pharmacopœia*:—

“Take of Rectified Spirit ℥ij; Sulphuric Acid ℥iv; Solution of Potash, Distilled Water, of each fʒj; or as much as may be sufficient. Mix the acid cautiously with the spirit. Let the liquor distil until a black froth arises; then immediately remove the retort from the fire. Separate the lighter supernatant liquor from the heavier one, and expose the former to the air for a day. Add to it the solution of potash first mixed with water, and shake them together. Lastly, when sufficiently washed, separate the ethereal oil which subsides.”

The *Dublin College* gives the following directions for its preparation: “Take of Rectified Spirit one pint and a half; Oil of Vitriol of commerce one pint and a half; Sulphuric Ether five fluidounces. Mix the oil of vitriol with one pint of the rectified spirit, in a matrass of glass, and, connecting this with a Liebig’s condenser, apply heat, and distil, till a black froth begins to rise. Separate the uppermost or lighter stratum of the distilled liquid, and, having exposed it in a capsule for twenty-four hours to the atmosphere, let the residual oil be transferred to a moist paper filter, and washed with a little cold water, so as to remove any adhering acid. Let it now be introduced into a bottle containing the remainder of the spirit mixed with the ether, and dissolved.”

[The *U. S. Pharm.* directs the following method: Take of Alcohol Oij; Sulphuric Acid Oij; Solution of Potassa fʒss; Distilled Water fʒj. Mix the Acids cautiously with the Alcohol, and allow the mixture to stand for twelve hours; then pour it into a large glass retort, to which a receiver kept cool by ice is adapted, and distil by means of a sand-bath until a black froth rises, when the retort is to be removed immediately from the sand-bath. Separate the lighter supernatant liquid in the receiver from the heavier, and expose it to the air for a day; then add to it the Solution of Potassa previously mixed with the distilled water, and shake them together. Lastly, separate the Ethereal Oil as soon as it has subsided.]

The process of the *London Pharmacopœia* is that followed at Apothecaries’ Hall, London. The late Mr. Hennell informed me that 33 lbs. avoird. of Rectified Spirit, and 64 lbs. avoird. of Oil of Vitriol, yielded in one operation 17 ounces avoird. of ethereal oil. There is, therefore, an immense loss in the operation.

THEORY OF THE PROCESS.—When oil of vitriol and alcohol are mixed, bisulphate of oxide of ethyle ($C^4H^5O, 2SO^3$) and water are formed. Under the influence of heat, the bisulphate suffers decomposition; but the reactions vary with the temperature. When the sulphuric acid is greatly in excess, and the boiling point of the liquid has attained 320° F., the principal products of the decomposition are sulphurous acid, olefiant gas (carbo-hydrogen), water, and carbon. At this period of the process, heavy oil of wine is also produced in small quantity. Its formation may be accounted for by supposing that two equivalents of the bisulphate of oxide of ethyle and water react on one another, and that the carbo-hydrogen ($C^4H^4=1$ eq. Etherole) of the one is substituted for the water of the other; the products being heavy oil of wine (*oleum æthereum*, Ph. L.), sulphuric acid, and water.

The substance termed by Liebig **ETHEROLE** (C^4H^4) is commonly denominated *Light Oil of Wine*. It was discovered by Hennell, who calls it *Hydrocarbon from Oil of Wine*, because it is obtained by boiling the heavy oil of wine with water. It is a colourless oily liquid, of sp. gr.

¹ *Traité de Chimie*, v. 543.

² *Philosophical Transactions*, 1826.

³ *Op. supra cit.*

⁴ *Turner’s Elements of Chemistry*, 7th edit. pp. 844 and 861, 1841.

⁵ The term *etherole* is applied to a $\frac{1}{2}$ carbo-hydrogen, better known as *Light Oil of Wine*.

0.917 to 0.920. When kept for some time at a low temperature, it deposits a crystalline matter called *ETHERINE* or *Camphor of Oil of Wine* (C^4H^4), which is isomeric with etherole.

PROPERTIES.—Ethereal oil is an oily liquid, having usually a yellowish tint, though, when quite pure, it is said to be colourless. It has a peculiar aromatic odour, and a bitter taste. Its sp. gr. according to Mr. Hennell, is 1.05; but, according to Serullas, it is 1.13. It boils at $540^\circ F$. It is insoluble in water, but dissolves readily in alcohol and ether. It neither reddens litmus nor precipitates a solution of chloride of barium, so that the sulphuric acid contained in it seems to be completely neutralized. According to Mr. Hennell, ethereal oil dissolves a variable quantity of a $\frac{4}{5}$ carbo-hydrogen, part of which separates in a crystalline form (*etherine*) when the oil is kept for some time, or when exposed to cold. When ethereal oil is slightly heated with water, it yields a light yellow oil (*etherole*), which floats on water, and bisulphate of oxide of ethyle, which is dissolved by the water.

CHARACTERISTICS.—Ethereal oil is recognized by its oily appearance, its peculiar odour and taste, its slight solubility in, but greater specific gravity than, water, and its solubility in ether and alcohol. If it be heated in a test-tube, it yields an inflammable vapour which burns like olefiant gas, and a carbonaceous residue which contains sulphuric acid, as is proved by lixiviating with water, and testing by chloride of barium. Ethereal oil, added to a solution of chloride of barium, occasions no cloudiness; but, if we evaporate the mixture to dryness, the residue is found to contain sulphate of baryta.

COMPOSITION.—Three chemists have analyzed ethereal oil, namely, Hennell, Serullas, and Liebig. The results of two only of these agree, namely, those of Liebig and Serullas.

LIEBIG AND SERULLAS.					HENNELL.		
	Atoms.	Eq.Wt.	Theory.	Liebig.	Serullas.	Eq.	Eq.Wt. Per Cent.
Sulphuric acid	2	80	55.172	55.614	55.02	1	40 38.0
Carbon	8	48	33.103	33.180	33.05	9	54 53.7
Hydrogen	9	9	6.207	5.788	6.11	9	9 8.3
Oxygen	1	8	5.517	5.418	5.49	0	0 0.0
Oleum Æthereum } (Ph. L.) }	1	145	99.999	100.000	99.67	1	103 100.0

It would appear from this table that Hennell¹ must have analyzed ethereal oil holding in solution carbo-hydrogen (*etherine*), and that he omitted to take into calculation the elements of water which this oil contains.

According to Serullas² and Liebig,³ this oil is a double sulphate of oxide of ethyle (ether) and etherole (carbo-hydrogen).

	Atoms.	Eq.Wt.	Or,	Atoms.	Eq.Wt.
2 eq. sulphuric acid	2	80	Sulphate of oxide of ethyle (ether)	1	77
1 eq. oxide of ethyle (ether)	1	37	Sulphate of etherole (carbo-hydro-	1	68
1 eq. etherole (carbo-hydrogen)	1	28	gen) }		
<hr/>			<hr/>		
1 Sulphate of Oxide of Ethyle and Etherole }	1	145	Sulphate of Oxide of Ethyle and Etherole }	1	145

Dumas,⁴ however, regards it as true sulphatic ether (SO^3, C^4H^5O), holding in solution variable quantities of carbo-hydrogen.

PHYSIOLOGICAL EFFECTS.—These have not been determined. I gave fifteen drops to a small rabbit: death took place within an hour. The symptoms were indisposition to move, apparent tendency to sleep, followed by incapability of supporting the erect position, occasional convulsive movements, grating of the teeth, and insensibility. The body was opened immediately after death; the heart was still beating, and its right cavities were gorged with purple blood. Ethereal oil, therefore, acts on the nervous system in a somewhat analogous way to ether.

USES.—Ethereal oil is used in the manufacture of the *Spiritus Ætheris Compositus* of the Pharmacopœia.

¹ *Philosophical Transactions* for 1826. pp. 247—S.

² *Turner's Elements of Chemistry*, 7th edit. pp. 844 and 861.

³ *Traité de Chimie appliquée aux Arts*, v. 545, Paris, 1835.

⁴ *Ann. de Chim. et de Phys.* XXXIX. 153.

"Dr. Hare," in his *Chemical Compendium*, "reports the opinions of Drs. Physick and Dewees in favour of the efficacy of the official oil of wine, dissolved in alcohol, in certain disturbed states of the system, as a tranquillizing and anodyne remedy."¹

303. SPIRITUS ÆTHERIS NITRICI, L. E. [U. S.].—SPIRIT OF NITRIC ETHER, OR SWEET SPIRIT OF NITRE.

(Spiritus æthereus nitrosus, D.—Hyponitrous ether, with four volumes of rectified spirit, E.)

HISTORY.—The first traces of this preparation are to be found in the writings of Raymond Lully, in the 13th century.² Basil Valentine, in the 15th century, taught a much improved method of preparing it.³ Nitric ether was first mentioned by Kunkel, in 1681.⁴ It has been known under various names, such as *Dulcified Acid of Nitre* (*Acidum Nitri dulcificatum*), *Sweet Spirit of Nitre* (*Spiritus Nitri dulcis*), *Spirit of Nitrous Ether* (*Spiritus Ætheris Nitrosi*), and *Nitre Drops*.

PREPARATION.—It is usually prepared by the action of nitric acid on rectified spirit at one operation, as in the process of the *London College*, which is that employed at Apothecaries' Hall, London. Or it may be procured by first preparing nitric [hyponitrous] ether, and subsequently diluting this with rectified spirit, as in the process of the *Edinburgh College*.

1. Preparation of Hyponitrous Ether.—Liebig⁵ has lately given the following method of obtaining this compound in a state of purity: "One part of starch, and ten parts of nitric acid, sp. gr. 1.3, are introduced into a capacious retort, which is connected by means of a wide tube, bent at right angles, with a two-necked bottle, so that the farther end of the tube reaches to the bottom of the bottle. Into this bottle is introduced a mixture of two parts of alcohol at 85 p. c. and one part of water, and it is surrounded by cold water. The second aperture of the bottle is connected, by means of a long wide tube, with a good cooling apparatus or condenser. The starch and nitric acid are heated in the water-bath; pure hyponitrous acid is disengaged, which, passing through the alcohol, instantly combines with the ether, forming hyponitrite of oxide of ethyle, which distils in a continuous stream. This process is very productive. By means of water, the new ether is purified from alcohol, and by standing over chloride of calcium it is freed from water. The tube which connects the retort with the two-necked bottle must have a length of two or three feet, and must be surrounded with moist paper during the operation. If the alcohol be not carefully cooled, it becomes spontaneously hot, and boils violently. From this moment the hyponitrite of ethyle is no longer pure."

The process of the *Edinburgh College* for the preparation of hyponitrous ether is as follows: Take of Rectified Spirit Oij and ℥vj; Pure Nitric Acid (density 1.500) ℥vj. Put fifteen fluidounces of the spirit, with a little clean sand, into a two-pint matrass, fitted with a cork, through which are passed a safety-tube, terminating an inch above the spirit, and another tube leading to a refrigerator. The safety-tube being filled with pure nitric acid, add through it gradually three fluidounces and a half of the acid. When the ebullition which slowly arises is nearly over, add the rest of the acid gradually, half a fluidounce at a time, waiting till the ebullition caused by each portion is nearly over before adding more, and cooling the refrigerator with a stream of water, iced in the summer. The ether thus distilled over being received in a bottle, is to be agitated first with a little milk of lime, till it ceases to reddens litmus paper, and then with half its volume of concentrated solution of muriate of lime. The pure hyponitrous ether thus obtained should have a density of 0.899.

The theory of Liebig's process for making hyponitrous ether is simple. Starch deoxidizes nitric acid and evolves hyponitrous acid [the nitrous acid of Graham and continental chemists]. This being conveyed into alcohol, combines with the oxide of ethyle of the latter, and disengages the water.

¹ *United States Dispensatory*.

² Dulk, *Die Preussische Pharmakopöe übers. und erläutert*, 2er Th. S. 701. 5te Aufl. Leipz. 1830.

³ *Ibid.*

⁴ Thomson, *System of Chemistry of Inorganic Bodies*, 7th edit. ii. 317, 1831.

⁵ Turner's *Elements of Chemistry*, 7th edit. p. 848.

Hyponitrous ether is, however, usually prepared by the action of nitric acid on alcohol; as in the Edinburgh and Dublin processes. The reactions are then more complicated, but vary with the strength of the acid and the temperature. They essentially depend on the deoxidation of the nitric acid by the hydrogen and carbon of the ethyle of part of the alcohol. As hydrogen has more affinity than carbon for oxygen, it follows that in the earlier stages, and when reaction is moderate, it is the hydrogen of the ethyle which is oxidized by the oxygen of the nitric acid. Thus, when we employ a dilute acid, or moderate the reaction by cold, the products are aldehyd (hydrated oxide of acetylene¹), water, and hyponitrous ether. When, however, the reaction is more energetic, as when strong nitric acid is employed, and the temperature is not moderated, the carbon as well as the hydrogen of the ethyle is oxidized by the oxygen of the acid, and several products, besides those above-mentioned, are then obtained. Carbonic (CO^2) and oxalic (C^2O^3) acids are formed by the oxidation of the carbon. Acetic ($\text{C}^4\text{H}^3\text{O}^3$) and formic ($\text{C}^2\text{H}\text{O}^3$) acids are also generated; "besides acetate and formate of ethyle" (Liebig). By the deoxidation of nitric acid there are obtained, besides hyponitrous acid already mentioned, nitrous acid, binoxide of nitrogen, protoxide of nitrogen, and nitrogen (Thénard).

2. Preparation of Spiritus Ætheris Nitrici.—The processes of all the British Colleges differ from each other.

The *London College* orders of Rectified Spirit ℥iij; Nitric Acid ℥iv. Add the Acid gradually to the Spirit, and mix; then let 32 fluidounces distil.

The *Edinburgh College* directs the pure hyponitrous ether (obtained by the process above detailed) to be mixed with the remainder (i. e. ℥xxxj) of the rectified spirit, or exactly four times its volume. Spirit of nitric ether ought not to be kept long, as it always undergoes decomposition, and becomes at length strongly acid. Its density, by this process, is 0.847.

The directions of the *Dublin College* are as follows: Take of Rectified Spirit two pints and eight fluidounces; Pure Nitric Acid three fluidounces; Water one ounce; Solution of Ammonia a sufficient quantity. Place six ounces of the spirit in a glass matrass capable of holding a quart, and connect this with a Liebig's condenser, whose farther extremity is fitted loosely by a collar of tow into a thin eight-ounce phial. Add now the water to the nitric acid, and, having introduced half of the resulting solution into the matrass, through a safety syphon tube, close the mouth of this tube with a cork, and apply for a few moments a gentle heat, so as to cause a commencement of ebullition. When the action (which, shortly after commencing, proceeds with much violence, and should be moderated by the external application of cold water) has relaxed, introduce gradually the remainder of the acid, so as to restore it. The action having entirely ceased, agitate the distilled product with half its bulk of the solution of ammonia, allow the mixture to rest for a few minutes, and, having separated the supernatant ethereal liquid, mix four ounces of it with the rest of the spirit, and preserve the product in small, strong, and accurately stopped bottles.

In the performance of the preceding distillation, the condenser should be fed with ice-cold water, and the phial, in which the distilled liquid is received, should be surrounded by a mixture of one part salt and two of pounded ice; or, when ice cannot be procured, with a mixture of eight parts of sulphate of soda in small crystals and five of commercial muriatic acid.

[The following are the directions of the *U. S. Pharm.*: Take of Nitrate of Potassa, in coarse powder, ℥ij; Sulphuric acid ℥iiss; Alcohol Oixss; Diluted Alcohol Oj; Carbonate of Potassa ℥j. Mix the Nitrate of Potassa and the Alcohol in a large glass retort, and having gradually poured in the acid, digest with a gentle heat for two hours; then raise the heat and distil a gallon. To the distilled liquor add the Diluted Alcohol and Carbonate of Potassa, and again distil a gallon.]

At Apothecaries' Hall, London, this preparation is made in an earthenware still, with a condensing worm of the same material. The still is heated by the slow application of steam to its outer surface.² The theory³ of the process is essentially the same as that for preparing pure hyponitrous ether. The latter, when formed,

¹ Acetylene, and the oxide of acetylene, are hypothetical substances. Aldehyd is regarded as the hydrate of the hypothetical oxide of acetylene.

² Brande, *Manual of Pharmacy*, 3d edit. p. 461. London.

³ Dr. Golling Bird (*Lond. and Edinb. Phil. Mag.* 1839, vol. xiv. p. 324) says, that while the ether distills, mixed with alcohol only, oxalhydric [saccharic] acid ($\text{C}^2\text{H}^4\text{O}^6$), but no oxalic acid is formed. He also states, that aldehyd is generated, but does not appear in the distilled liquid until the formation of ether has nearly or entirely ceased; the aldehyd and oxalic acid being nearly of simultaneous origin.

distils over along with rectified spirit, and constitutes the Spiritus ætheris nitrici, *Ph. L.*

PROPERTIES. *a.* OF HYPONITROUS ETHER.—*Pure hyponitrous ether*, prepared by Liebig's process, is pale-yellow, has a most fragrant smell of apples and Hungary wines, boils at 62°, and has the sp. gr. of 0.947 at 60°. It may be mixed with an alcoholic solution of potash without becoming brown (showing the absence of aldehyd); hyponitrite of potash and alcohol are formed. *Impure hyponitrous ether*, prepared by the ordinary processes, boils at 70° F., and has the sp. gr. 0.886 at 40°. Its smell is like that of the former, but at the same time suffocating. Mixed with an alcoholic solution of potash it becomes dark-brown (showing the presence of aldehyd), with the production of resin of aldehyd. It is highly inflammable, burning with a bright flame. When kept it becomes acid, while nitric oxide gas is given off. This tendency to become acid is greater when air is admitted, and depends on the presence of aldehyd, which is oxidized by the oxygen of the air or of the hyponitrous acid. It is soluble in 48 parts of water, and miscible, in all proportions, with ether and alcohol (Liebig). The following is the composition of the pure hyponitrous ether:—

Dumas and								
	At.	Eq.Wt.	Theory.	Boullay.	Or,	Atoms.	Eq.Wt.	Per Cent.
Carbon . . .	4	24	32.00	32.69	Hyponitrous	}	55	50.66
Hydrogen . .	5	5	6.67	6.85	Acid			
Oxygen . . .	4	32	42.67	41.46	Oxide of Ethyle	}	37	49.34
Nitrogen . .	1	14	18.66	19.00	(Ether) . . .			
Hyponitrous	}	75	100.00	100.00	Hyponitrite of	}	75	100.00
Ether . . .					Oxide of Ethyle			

β. OF SPIRITUS ÆTHERIS NITRICI.—Spirit of nitric ether is a colourless, limpid liquor, having a fragrant ethereal odour, somewhat analogous to that of ripe apples, and a pungent, aromatic, sweetish acidulous taste. Prepared according to the London Pharmacopœia, its sp. gr. should not exceed 0.834; but the preparation of the Edinburgh Pharmacopœia has a sp. gr. of 0.847. It is very volatile, producing much cold by its evaporation. It is very inflammable, and burns with a whitish flame. By keeping, it usually becomes strongly acid; though I have had some kept for several years which possessed only slight acidity. It dissolves in alcohol and water in all proportions. "Hyponitrous ether may be separated from the alcohol, water, and uncombined acid, which the preparation of the pharmacopœia contains, by digesting lime reduced to powder in it, and subjecting the mixture to distillation."¹

CHARACTERISTICS.—It is principally distinguished by its peculiar odour, its inflammability, its lightness, and its miscibility with water. The spirit of nitric ether of the shops usually strikes a deep olive colour with the proto-sulphate of iron, thereby indicating the presence of binoxide or an acid of nitrogen; and produces, with tincture of guaiacum, a blue tint, which passes through various shades of green; this last effect depends on the presence of an acid of nitrogen. These effects are not invariably produced; for in some spirit of nitric ether, which I have had for several years, they do not take place.

COMPOSITION.—Spirit of nitric ether is a mixture of [impure] *hyponitrous ether* and *rectified spirit*. Prepared according to the Edinburgh Pharmacopœia, its composition is as follows:—

	Vols.	Sp. gr.	Weight.
Hyponitrous ether	1	0.886	20.9
Rectified spirit	4	0.838	79.1
Spiritus Ætheris Nitrici, <i>Ph. Ed.</i>	5	0.847	100.0

PURITY.—Few articles of the pharmacopœia are more extensively adulterated than spirit of nitric ether. To prove how great a fraud must be practised with it,

¹ Mr. R. Phillips, *Translation of the Pharmacopœia*, 4th edit. Lond. 1811.

I may mention that, in July, 1840, Mr. Hennell informed me that it was then selling in the trade at a price which was but just above that of the duty on the spirit used in manufacturing the genuine article. Wholesale dealers usually keep two, or even three, qualities of this preparation; the inferior ones being obtained by diluting the best with different quantities of water, or spirit of wine and water. Some years since, large quantities of spirit of wine, flavoured with hyponitrous ether, were imported from Ireland into London, under the name of spirit of nitric ether, in order to evade the duty payable on it as spirit of wine. Aldehyd and an acid of nitrogen are accidental impurities frequently present. The goodness of spirit of nitric ether is to be estimated in part by an attentive examination of the flavour, and by taking the specific gravity of this liquid. Prepared according to the process of the London Pharmacopœia, its density is 0.834. A free acid (an acid of nitrogen) may be recognized by litmus, and by the effervescence produced on the addition of the alkaline carbonates. The *Edinburgh College* gives the following characteristics of the purity of spirit of nitric ether:—

“Density, 0.847; it effervesces feebly, or not at all, with a solution of bicarbonate of potash. When agitated with twice its volume of muriate of lime, 12 per cent. of ether slowly separates.”

Two samples of spirit of nitric ether, prepared by Messrs. Howard and Co., of Stratford, I found to be 47.8 *over proof*, according to Sikes’s hydrometer; indicating the sp. gr. to be about 0.85. But I failed to separate the hyponitrous ether by the use of a solution of muriate of lime, as directed by the *Edinburgh College*.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Its effects on plants have not been ascertained.

β. On Animals.—I am not acquainted with any experiments made to determine its effects on animals generally. Veterinarians employ it as a diuretic on various occasions, and as a stimulant in the advanced stages of fever, to rouse the exhausted powers of horses.¹

γ. On Man.—The inhalation of its vapour is dangerous when too long continued, as is proved by the following case: A druggist’s maid-servant was found one morning dead in her bed, and death had evidently arisen from the air of her apartment having been accidentally loaded with the vapour of this liquid from the breaking of a three-gallon jar of it. She was found lying on her side, with her arms folded across the chest, the countenance and posture composed, and the whole appearance like a person in a deep sleep.² The use of ether vapour in surgical operations has led to fatal results in several instances. Taken as a liquid internally, in moderate doses, it operates as a volatile stimulant and diuretic. According to the experiments of Alexander, it acts mildly on the kidneys. It is believed to possess diaphoretic properties. By some pharmacologists it is described as being refrigerant, a quality which it owes perhaps to the free acid which it usually contains. I am unacquainted with the effects of large doses, but they are probably analogous to, though less energetic than, those of other ethereal compounds. Kraus³ says a boy twelve years of age took a drachm in the morning fasting, and that it caused violent colic, which lasted for six hours, and was accompanied with vomiting. Probably these effects arose from the preparation containing a considerable quantity of free acid.

USES.—It is employed as a diuretic in some disorders of children, and in mild dropsical complaints, as in the anasarca which follows scarlatina. It is given in conjunction with squills, acetate or nitrate of potash, or foxglove. As a refrigerant and diaphoretic, it is used in febrile complaints in combination with the acetate of ammonia and emetic tartar. As a carminative, it is frequently useful in relieving flatulence and allaying nausea. On account of its volatility, it may be applied to produce cold by its evaporation. Spirit dealers employ it as a flavouring ingredient.

¹ Youatt. *The Horse*, in the *Library of Useful Knowledge*.

² Christison’s *Treatise on Poisons*.

³ *Heilmittellehre*, S. 454, Göttingen, 1831.

ADMINISTRATION.—The usual dose of this liquid, in febrile cases, is ℥ss to ℥ij, or ℥iij. When we wish it to act as a diuretic, it should be given in large doses, as two or three teaspoonfuls.

ANTIDOTES.—In poisoning by the inhalation of the vapour of this compound, the treatment will be the same as that described for poisoning by carbonic acid gas.

304. ÆTHER HYDROCHLORICUS.—HYDROCHLORIC ETHER.

HISTORY AND SYNONYMES.—In the Edinburgh Pharmacopœia for 1735, was a preparation called *Spiritus Salis dulcis*. It was a solution of hydrochloric ether in rectified spirit. Very little, however, was known of the properties of this ether till Gehlen published a dissertation on the subject, in 1804.¹ This ether has had various appellations, such as *Chlorhydric Ether*, *Muriatic Ether*, *Marine Ether*, and, hypothetically, *Chloride of Ethyle*.

PREPARATION.—It is best obtained by saturating alcohol with hydrochloric acid gas, and distilling, by means of a water-bath, into a carefully cooled receiver.

By the reaction of one equivalent or 37 parts of hydrochloric acid (HCl) on one equivalent or 46 parts of alcohol ($C^4H^5O + HO$), we obtain one equivalent or 65 parts of hydrochloric ether (C^4H^5Cl) and two equivalents or 18 parts of water (2HO).

PROPERTIES.—Hydrochloric ether is a colourless liquid, having a penetrating odour, and a taste somewhat sweetish. Its sp. gr. is 0.874 at 40° F. It boils at 51° F. This great volatility prevents its being kept in the shops. When pure it is quite neutral, dissolves in about 24 parts of water, does not precipitate nitrate of silver, and burns with a flame edged with green, producing vapours of hydrochloric acid. By the slow action of hydrate of potash on it, chloride of potassium and alcohol are formed.

Its composition is as follows:—

	Atoms.	Eq.Wt.	Per Cent.	Or,	Atoms.	Eq.Wt.	Per Cent.
Carbon	4	24	36.92	Ethyle	1	29	41.61
Hydrogen	5	5	7.69	Chlorine	1	36	55.38
Chlorine	1	36	55.38				
Hydrochloric Ether .	1	65	99.99	Chloride of Ethyle . .	1	65	99.99

PHYSIOLOGICAL EFFECTS AND USES.—It is a highly diffusible stimulant, like the other ethers, but is rarely employed alone; though it has been used as an anti-spasmodic.

SPIRITUS ÆTHERIS HYDROCHLORICI; Æther Muriaticus Alcoholicus; Spiritus Muriatico-Æthereus; Spiritus Salis dulcis; Spirit of Hydrochloric Ether; Spirit of Muriatic Ether; Dulcified Marine Acid.—In the Edinburgh Pharmacopœia for 1735, this was ordered to be prepared by adding one part of muriatic acid to three parts of rectified spirit, digesting for some days, and then distilling by a sand heat. Or it may be prepared by dissolving hydrochloric ether in an equal volume of rectified spirit. Liebig says, that the spiritus muriatico-ethereus, used on the continent, contains *heavy muriatic ether*, the composition of which is not known. The action of spirit of muriatic ether seems to be similar to that of spirit of nitric ether. A scruple of it thrown into the veins of a buck, augmented the renal secretion.² An ounce and a half injected into the jugular vein of a dog, coagulated the blood, caused difficulty of breathing, and death.³ It has been used in dyspeptic affections connected with hepatic obstructions. In hectic fever, Berends⁴ found its continued use beneficial. The dose of it is ℥j to ℥iij.

¹ Thomson's *System of Chemistry of Inorganic Bodies*, 7th edit. ii. 310, Lond. 1831.

² Lanzoni, quoted by Wibmer, *Die Wirkung*, &c. Bd. i. S. 56.

³ Freund, quoted by Wibmer.

⁴ Sundelin, *Handbuch der speciellen Heilmittellehre*, Bd. ii. S. 71, 3tte Aufl. Berlin, 1853.

305. **ÆTHER ACETICUS.—ACETIC ETHER.**

HISTORY.—It was discovered by Count de Lauraguais, in 1759.¹

PREPARATION.—It is prepared by submitting to distillation a mixture of 16 parts of dry acetate of lead, $4\frac{1}{2}$ of alcohol, and 6 of oil of vitriol; or 10 parts of crystallized acetate of soda, 15 of oil of vitriol, and 6 of alcohol, at 80 or 85 per cent. The product is rectified with slaked lime and chloride of calcium, to remove acid and water; and a quantity of acetic ether, equal in weight to the alcohol, is obtained (Liebig).

PROPERTIES.—Acetic ether is colourless, and has an agreeable odour of acetic acid and ether. Its sp. gr. is 0.89 at 60°. It boils at 165°. It is soluble in 7 parts of water, and mixes with alcohol and ether in every proportion. Oil of vitriol resolves it into ether and acetic acid.

COMPOSITION.—The composition of this ether is as follows:—

	Atoms.	Eq.Wt.	Per Cent.	Or,		Atoms.	Eq.Wt.	Per Cent.
Carbon	8	48	54.54	Ethyle	1	29	32.95	
Hydrogen	8	8	9.1	Oxygen	1	8	9.1	
Oxygen	4	32	36.36	Acetic acid	1	51	57.95	
Acetic Ether	1	88	100.00	Acetate of the Oxide of Ethyle	1	88	100.00	

PHYSIOLOGICAL EFFECTS AND USES.—Acetic ether is not used in medicine in this country. On the continent, however, it is occasionally employed. It is somewhat similar in its operation to the other ethers; but is milder, more agreeable, and more diaphoretic. It is used in nervous and putrid fevers, in cardialgia, spasmodic vomiting, and asthenic affections of the stomach and alimentary canal.² Dose, fʒss. to fʒij.

306. **CHLOROFORMYL, *L.*—CHLOROFORM, OR TERCHLORIDE OF FORMYLE.³**

Chloroformum, *D.* [*U. S.*].

HISTORY.—The term *chloric ether* was applied by Dr. T. Thomson⁴ to the liquid formed by the union of equal volumes of chlorine and olefant gas, and which is described in different chemical works under the name of *chloride of olefant gas*, or the *Dutch liquid*. The formula of this liquid is $C^4H^3Cl^2$. In 1831, Mr. Guthrie, an American chemist, was led to attempt a cheap and easy process for preparing it, by a statement in Silliman's *Elements of Chemistry*, that the alcoholic solution of chloric ether was a grateful and diffusible stimulant. His process was as follows:—⁵

"Into a clean copper still put three pounds of chloride of lime and two gallons of well-flavoured alcohol, of sp. gr. 0.844, and distil. Watch the process, and when the product ceases to come over highly sweet and aromatic, remove and cork it up closely in glass vessels. The remainder of the spirit should be distilled off for a new operation. These proportions are not essential—if more chloride of lime be used, the ethereal product will be increased; nor is it necessary that the proof of the spirit should be very high, but I have commonly used the above proportions and proof, and have every reason to be satisfied with them. From the above quantity I have usually obtained about one gallon of ethereal spirit."

Both Guthrie and Silliman erroneously believed the liquid thus obtained to be an alcoholic solution of the chloride of olefant gas, and hence they termed it *chloric ether*. In 1831, Soubeiran⁶ submitted to distillation a mixture of chloride of lime and alcohol, and examined the distilled product. He found it to consist of

Carbon	14.39
Hydrogen	2.35
Chlorine	83.26
	100.00

¹ Thomson, *op. supra cit.*

² Sundelin, *op. supra cit.*

³ This article has been partly drawn up from a paper published by the author in the *Pharmaceutical Journal* for March, 1846, vol. v. No. ix.

⁴ *System of Chemistry*, 6th edit. 1820.

⁵ Silliman's *American Journal of Science and Art* for Jan. 1832, vol. xxi. p. 61.

⁶ *Ann. de Chim. et de Phys.* t. xlviii. p. 131.

The atomic composition which he gave for this liquid was, when reduced to the English mode of calculation, CHCl ; or $\text{C}^3\text{H}^4\text{Cl}^4$. He termed the liquid *bichloric ether*, because it contains, as he says, twice as much chlorine as is contained in the chloride of olefiant gas. In 1832, Liebig¹ examined the product obtained by submitting to distillation, in a capacious retort, diluted alcohol and chloride of lime. He analyzed the distilled product, but failed to detect hydrogen in it. According to his experiments, the compound consisted of

Carbon	12.6523
Chlorine	88.18
	<hr/>
	100.8323

The formula which he deduced from this analysis was C^3Cl^3 , and he called the liquid *chloride of carbon*.

In 1834, Dumas² examined this liquid. He showed that Soubeiran had not obtained it pure, and that Liebig had made an error with regard to its composition. From his analysis of the pure liquid, he deduced the following as its real formula: C^2HCl^2 . On account of the relation of its composition to that of formic acid, C^2HO^3 , the oxygen being replaced by three equivalents of chlorine, Dumas denominated this liquid *Chloroform*. Liebig has admitted the accuracy of Dumas's analysis by adopting his formula of the composition of this liquid. He has, however, discarded Dumas's name for this substance, and adopted that of the *chloride* or *perchloride of formyle* (*Formyl-chlorid*). Thus, then, it appears that the liquid now used in medicine under the names of *chloric ether* and *terchloride of carbon*, is altogether different from the chloride of olefiant gas, to which the name chloric ether was originally applied. Both of these names (chloric ether and terchloride of carbon) have been given to it from erroneous notions entertained of its nature and composition.³

[PREPARATION.—This compound, the vapour of which is so largely employed for anæsthetic purposes in surgical and obstetric practice, has been introduced into two of the Pharmacopœias, both of which contain formulæ for its preparation.

The directions of the *London College* are as follows: Take of Chlorinated Lime ℥iv; Rectified Spirit Oss; Water Ox; Chloride of Calcium, broken into pieces, ʒj. Put the lime first mixed with the water into a retort, and add the spirit to them, so that the mixture may fill only the third part of the retort. Then heat them in a sand-bath, and, as soon as ebullition begins, withdraw the heat as quickly as possible, lest the retort should be broken by the sudden increase of heat. Let the liquid distil into the receiver so long that there may be nothing which subsides, the heat being reapplied if necessary. To the distilled liquid add a quarter of the water, and shake them all well together. Carefully separate the heavier portion which subsides, and add the chloride to it, and frequently shake them for an hour. Lastly, let the liquid distil again from a glass retort into a glass receiver.

The *Dublin College* gives the following formula: Take of Chlorinated Lime ℥x; Fresh-burned Lime ℥v; Water Cong. iv; Rectified Spirit ʒxxv; Peroxide of Manganese, in fine powder, ʒij. Slake the lime with a quart of the water, first raised to the boiling temperature, and, having placed the slaked lime and the chlorinated lime in a sheet-iron or copper still, pour on the residue of the water first mixed with the spirit, and raised to the temperature of 100°. Connect now the still with a condenser, and apply heat, which, however, must be withdrawn the moment the distillation commences. The distilled product, the bulk of which need not exceed a quart, will occur in two distinct strata, the lower of which is the crude chloroform. Let this be agitated twice in succession, with an equal volume of distilled water, and then in a separate bottle with half its volume of pure sulphuric acid. Lastly, let it be shaken in a matrass with the peroxide of manganese, and rectified from off this at a very gentle heat. The specific gravity of chloroform is 1496. The lighter liquid which distils over with the chloroform, and the water used in washing the latter, should be preserved with the view of their being introduced, with a new charge, into the still in a subsequent process.

[The *U. S. P.* directs the following: Take of Chlorinated Lime ℥x; Water Oijss; Alcohol Oij. Mix the chlorinated lime first with the water, and then with the alcohol, in a distillatory vessel having the capacity of six gallons. Distil with a brisk heat into a refrigerated receiver, and, when the temperature approaches 176°, withdraw the fire, in order that the distillation may proceed by the heat de-

¹ *Ann. de Chim. et de Phys.* t. xlix. p. 146.

² *Pharmaceutical Journal*, vol. v. No. xi.

³ *Ibid.* t. lvi. p. 113, 1834.

rived solely from the reaction of the materials. When the distillation slackens, hasten it by a fresh application of heat, and continue to distil until the liquid ceases to come over with a sweet taste. Separate the heavier layer of liquid in the receiver from the lighter by decantation, and, having washed it first with water, and then with a weak solution of carbonate of soda, agitate it thoroughly with powdered chloride of calcium, and distil it off by means of a water-bath, stopping the distillation when eleven-twelfths of the liquid have come over. The residue, together with the light liquid of the first distillation, may be reserved for use in a second operation.]

PROPERTIES.—It is a transparent, colourless liquid, having a sp. gr. of 1.48 *L.* or 1.496 *D.* It boils at 140° , and the density of its vapour is 4.2. It has a fragrant, ethereal, apple-like odour, and an ethereal, slightly acrid, but sweet taste. It is readily dissolved by alcohol and ether, but requires 2,000 parts of water to dissolve it, to which it imparts its peculiar odour. It is a powerful solvent, dissolving readily camphor, caoutchouc, wax, resins, and iodine. It is not inflammable, but communicates a dull, smoky yellow flame to alcohol.

COMPOSITION.—Its formula is well ascertained to be $C_2H_2Cl_3$.

ADULTERATIONS.—It may contain alcohol or ether—a fact indicated by a corresponding alteration in its sp. gr. Sulphuric acid may be detected in it by adding a solution of a salt of baryta to water with which it has been shaken. Chloroform itself is neutral, and should have no acid reaction.

PHYSIOLOGICAL EFFECTS.—In medicinal doses, chloroform is a stimulant, sedative, antispasmodic, and anæsthetic. In large doses, it causes profound coma and death. In man, it has been observed to cause excessive depression of the heart's action, and in persons affected with disease of this organ, ordinary doses have on several occasions proved fatal.

ADMINISTRATION.—Chloroform is seldom taken as a liquid; the dose is from five to ten minims, mixed with water and a little mucilage. The dose for inhalation of the vapour is from \mathfrak{zj} to $\mathfrak{z}ij$. Dr. Simpson, however, has used as much as eight fluidounces in thirteen hours, in a case of labour. Its administration requires great care, and some experience on the part of the practitioner.

USES.—Chloroform is now chiefly used as an agent for obtaining insensibility to pain during operations, and is therefore to be regarded more especially as an adjuvant to surgery. Before noticing the general history of its application in the above-mentioned manner, it may be well to state that it has also been used with advantage as a substitute for the ethers, and found to possess equal efficacy as a stimulant and antispasmodic. The form in which it has been ordinarily exhibited, is in admixture with rectified spirit; and it is sold in the shops in this diluted condition under the name of chloric ether. This is a most improper appellation, inasmuch as the term chloric ether is understood by chemists to refer to an oil-like fluid, formed by the reaction of chlorine upon olefiant gas (see page 930). This solution of chloroform is, for the most part, made by adding one part of that fluid to nine parts of rectified spirit; the dose for an adult being from $\mathfrak{m}xx$ to $\mathfrak{m}xl$ two or three times a day. It may be used as a substitute for the sulphuric ether in all cases requiring an antispasmodic and stimulant remedy; and as its flavour is preferred by most persons to that of the ethereal preparations, it may be advantageously prescribed where objection is made to the latter form of stimulant.

With respect to the mode of using chloroform as an anæsthetic agent, by introducing it into the circulation during the respiratory process, experience has shown that this can only be done with any degree of safety by allowing the vapour to be admixed with atmospheric air in considerable proportion before it is taken into the lungs. This is effected by a variety of contrivances. The principle on which the earlier instruments for inhaling were constructed, was to close the nasal aperture by a spring clasp, and so to insure the admission of the atmospheric air merely to the extent it might please the operator to permit by the mouth. The best instruments now in use are, however, constructed so as to allow the vapour to pass both by the nose and the mouth into the lungs, the patient being made to breathe through a mask. The form recommended by Dr. Snow, who has paid great attention to this

Fig. 395.



a. Outer case, containing water-bath, screwed on—*b.* Cylindrical vessel, into which the chloroform is put; it is lined with a coil or two of bibulous paper up to the point *c.* *d.* A cylindrical frame which screws into *b*; it has apertures at the top for the admission of air, and its lower two-thirds are covered with a coil or two of bibulous paper, which touches the bottom of the vessel *b*, except where the notches, *e*, are cut into it. *f.* Elastic tube. *g.* Expiratory valve of face-piece—the dotted lines indicate the position of this valve when turned aside for the admission of air not charged with vapour. *h.* Inside view of face-piece, pinched together at the top to adapt it to a smaller face. *i.* Inspiratory valve.¹

¹ *Directions for use.*—Unscrew the outer cylinder, and put into it as much water as will fill it when replaced; about 60° F. is the most suitable temperature for the water. Having replaced the water-bath, the chloroform (one to three fluidrachms, according to circumstances) is to be put into the inhaler, and the face-piece is next to be attached to it by means of the elastic tube. The face-piece should be moulded to the features of the patient, with the expiratory valve turned to one side, in the direction of the dotted lines in the engraving, and then this valve should be moved a little at each inspiration, till it gradually covers the opening; by this means the air charged with vapour from the apparatus will be admitted by degrees, to the exclusion of the external air, and thus any irritation of the air-passages, which might arise from the sudden access of air charged with vapour, will be avoided. It is recommended by Dr. Snow that the expiratory valve should be partially moved as if the patient's breathing be deeper or more rapid than in the natural state, and generally, also, in repeating the inhalation, to keep up insensibility during an operation. The lid which screws over the apparatus preserves any chloroform that is left until another occasion.

subject, is figured in the accompanying woodcut, for which we are indebted to Dr. Snow. The mask is of simple construction, and is fixed to an inhaler of Dr. Snow's invention, which enables the operator to adjust the proportion of chloroform vapour to atmospheric air. The directions for use, which are appended to the description of the inhaler, will enable the reader at once to understand the principle of its action. If from two to three drachms of chloroform be used, the air respired will contain from five to six per cent. of vapour of chloroform; and this is considered by Dr. Snow to be a safe proportion.

The important observations made by Dr. Snow, with respect to the action of chloroform on the lower animals, as well as the facts he has collected with regard to the deaths which have taken place in the human subject while chloroform was being inhaled, seem to have determined the following points very satisfactorily:—

1stly. Chloroform vapour, if it be inhaled in large proportion with atmospheric air, destroys life by paralyzing the heart.

2dly. In smaller proportions, but long continued, it produces death apparently by the brain, and by interfering with the respiratory function. In such cases the heart is found to beat after respiration has ceased.

3dly. Chloroform vapour, if it be blown upon the heart, paralyzes it immediately.

4thly. Atmospheric air, loaded with from 4 to 5, or even 6 per cent. of chloroform vapour, may be safely administered, inasmuch as that mixture will not act directly upon the heart, but will give timely notice of its increasing effects in modifying the normal discharge of the functions of life. The average time occupied in producing insensibility is from three to four minutes.

5thly. The proportion of as much as from 8 to 10 per cent. of vapour of chloroform to atmospheric air is a dangerous mixture, as it suddenly charges the blood going into the heart with a poison capable of acting directly on that organ.

From the above statement it would appear probable that many, if not all, the deaths which have so unfortunately occurred from the use of chloroform, have been the result of the too sudden administration of the vapour, and that in many cases much more than that quantity which caused dissolution might have been safely taken, had it been administered in a more diluted form.

To the experience of Dr. Snow, and the solid nature of his reasoning on this subject, we find opposed many very bold statements. Thus it has been recommended as the safest plan, to give the chloroform in large doses at once, and bring about anæsthesia as rapidly as can be effected. It is scarcely possible, however, after due consideration, to come to any other conclusion than that there has been more good luck than good management attending the practice of those gentlemen who act in direct opposition to rules laid down in accordance with the best results of careful experiment and accurate reasoning. Notwithstanding, however, that the knowledge we now possess may enable us, with due care, to protect from death healthy persons who inhale chloroform, it must be remembered that fatal cases must be expected in certain diseased conditions, even when every precaution has been taken. Thus it cannot be doubted, that where the heart is affected either with extensive disease of its component structures or of its valvular appliances, the dose of chloroform which might be perfectly safe in health may in such cases produce a fatal result. This remark especially applies where the heart is weakened either by fatty degeneration or fatty deposit, or where atrophy of its tissue and thinning of the walls of the organ have, to any considerable extent, lessened its muscular power. It unfortunately happens, too, that these conditions, and especially the former, are not always easily ascertainable during life. Again, we may expect that lesion of the brain, of an obscure character, may sometimes render the inhalation hazardous.

On the whole, then, even with every precaution, it would seem that to give chloroform to induce anæsthesia, is to introduce an additional element of danger during an operation. Experience has shown that this amount of danger is but very small; and therefore, when every care is taken, and no obvious disease can be detected in the internal organs of the patient, it may sometimes be justifiable to recommend the inhalation of chloroform, in order to secure the patient from suffering.

ANTIDOTES.—When too strong an effect is produced by the vapour, the patient should be placed in a horizontal posture, and cold effusion, with artificial respiration, should be resorted to.—ED.]

307. ACIDUM ACETICUM, L. E. D. [U. S.].—ACETIC ACID.

HISTORY.—Vinegar must have been known from the most remote periods of antiquity. It is mentioned by Moses,¹ 1490 years before Christ. Hippocrates² employed it (οξύς) medicinally. Hannibal, in his passage over the Alps, is said to have softened the rocks by fire and vinegar.³ Geber⁴ was acquainted with the purification of vinegar by distillation. Stahl, in 1723, obtained concentrated acetic acid from the acetates by the action of sulphuric acid.⁵

NATURAL HISTORY.—Acetic acid is peculiar to the organized kingdom. Acetic acid, free, or combined with potash, lime, or ammonia, is met with in the juices of many plants. Thus Vauquelin found the acetates of potash and lime in the sap of the elm; and Morin detected acetate of ammonia in the fruit of *Arca Catechu*. Many vegetable substances yield it by decomposition. Acetic acid is said to have been detected in the gastric juice, the perspiration, the urine, the milk, and the blood. It is probable, however, that in most, if not all, of these cases, lactic acid was mistaken for acetic acid.

Gmelin⁶ says, acetic acid has been found in some mineral waters. If the observation be correct, the acid is probably to be referred to some decomposing organic matter accidentally present in the water. Geiger⁷ states, that acetate of potash is found in some mineral waters.

PREPARATION.—The acetic acid of commerce is obtained from two sources—vinegar and pyroligneous acid: the first is procured by exciting the acetous fermentation in certain liquors, the other by the distillation of wood.

1. Acetous Fermentation.—All liquids which are susceptible of vinous fermentation may be made to yield vinegar. A solution of saccharine matter (or some substance capable of producing sugar) is the essential ingredient. It is converted, by fermentation, first into alcohol, and subsequently into acetic acid. The liquids employed in the manufacture of vinegar vary according to circumstances. In this country, the vinegar of commerce is obtained from an infusion of malt, or of a mixture of malt and raw barley. In wine countries, it is procured from inferior wines. Dilute spirit, beer, a solution of sugar, and other liquids, are also susceptible of the acetous fermentation.

1. Malt Vinegar (*Acetum*, L. [U. S.], *Acetum Britannicum*, or *British Vinegar*, E.).—This is prepared from malt, or a mixture of malt and raw barley, which is mashed with hot water, as in the ordinary operation of brewing. The cooled wort is then transferred to the fermenting tun, where it is mixed with yeast, and undergoes the vinous fermentation. The wash is then introduced into barrels standing endways, tied over with a coarse cloth, and placed close together in darkened chambers, artificially heated by a stove.⁸ Here the liquor remains until the acetous fermentation is complete. This process usually occupies several weeks, or even months. The product is not yet fit for sale. It is introduced into large tuns furnished with false bottoms, on which is placed *rape* (the residuary fruit which has served for making domestic wines). These rape-tuns are worked by pairs; one of them is quite filled with the vinegar from the barrels, and the other only three-quarters full, so that the fermentation is excited more easily in the latter than the

¹ Numbers, vi. 3.

² *De Natura Morb. lib. i.*

³ Livy, c. 37.—Polybius, however, from whom Livy has borrowed the greater part of his narrative, does not mention the use of vinegar. See some remarks on this subject in *A Dissertation on the Passage of Hannibal over the Alps*, p. 107, Oxford, 1820.

⁴ *Investigation of Perfection*, ch. iii.

⁵ Dulk, *Die Preussische Pharmac. übers. und erläutert*, 2 ter Th. S. 123, 2te Aufl. Leipz. 1830.

⁶ *Handb. d. Chem.* Bd. ii. S. 126.

⁷ *Handb. d. Pharm.* Bd. i. S. 601, 3tte Aufl.

⁸ The proper temperature is usually stated to be about 80° F.; but I suspect a much higher temperature is employed. I found the heat of one of these chambers so great, that I was unable to support it beyond a few minutes. The proprietor of the establishment (one of the largest vinegar works in the metropolis) refused to allow me to inspect the thermometer hanging up in the chamber.

former, and every day a portion of the vinegar is conveyed from one to the other, till the whole is completely finished, and fit for sale.¹ Green twigs, or fresh cuttings of the vine, recommended by Boerhaave, are sometimes employed, instead of rape, to flavour vinegar. Formerly acetification was effected by placing the wash in barrels, the bung-holes of which were loosely covered with tiles. These barrels were then exposed to the sun and air for several months, until the acetification was perfect. But the introduction of stoved chambers has nearly superseded this method.

Malt vinegar has a yellowish-red colour, an agreeable acid taste, which it owes to acetic and partly to sulphuric acid, and a peculiar refreshing pleasant odour, which it derives from acetic acid and acetic ether. Vinegar of four different degrees of strength is sold by the makers, and is distinguished as Nos. 18, 20, 22, and 24: the latter, which is the strongest, is also called *proof vinegar*, and is estimated to contain 5 per cent. of real acetic acid; but, according to Mr. Phillips, it does not usually contain more than 4.6 per cent. One fluidounce (= 446 grs.) of the latter strength should saturate very nearly 58 grs. of crystallized carbonate of soda. In the London Pharmacopœia, it is stated that one fluidounce should saturate 60 grs. of crystallized carbonate of soda: the two grains extra being "allowed for saturating the sulphuric acid permitted to be mixed with vinegar, and for decomposing the sulphates of the water used in vinegar-making."² The Edinburgh College fixes the density of British vinegar at from 1.006 to 1.012; but it is usually higher than this. Mr. Phillips³ found it, in one sample obtained from a respectable source, to be 1.019. Dr. T. Thomson found it to vary from 1.0135 to 1.0251. Vinegar is very liable to undergo decomposition; it becomes turbid, loses its acidity, acquires an unpleasant odour, and deposits a slippery gelatiniform substance. The mucilaginous coat or skin which forms on the surface of vinegar, and is called the *mother of vinegar*, appears to consist of myriads of exceedingly minute vegetables, having a globular form.⁴ The surface of vinegar is frequently covered by mouldiness (*Mucor Mucedo*). The microscopic animals, called Vinegar Eels⁵ (*Anguillula Aceti*), are generated and nourished in vinegar. They may be destroyed by submitting the liquid in which they are contained to heat. Vinegar is also infested by a small fly (*Musca cellaris*).

Malt vinegar consists of *water, acetic acid, acetic ether, colouring matter, a peculiar organic matter*, commonly denominated mucilage, a small portion of *alcohol*, and *sulphuric acid*. Vinegar-makers are allowed to add one-thousandth part by weight of sulphuric acid. This may be detected by a solution of chloride of barium, which forms a white precipitate (*sulphate of baryta*), insoluble in nitric acid. The quantity of sulphate of baryta thrown down from a fluidounce of vinegar, by the addition of solution of chloride of barium, should not exceed 1.14 grains.⁶ If the vinegar be free from copper, lead, tin, and other metallic matter, it yields no precipitate on the addition of hydrosulphuric acid (sulphuretted hydrogen). The presence of hydrochloric acid may be recognized by nitrate of silver, which produces a white precipitate (*chloride of silver*) with it, insoluble in nitric acid. The presence of nitric acid in vinegar may be recognized by boiling this liquid with indigo, which is rendered yellow by nitric acid. Or it may be detected by saturating the suspected acid with potash or soda, and evaporating to dryness; the residue deflagrates, when thrown on redhot coals, if nitric acid be present. The following is the note appended to the *Acetum* (P. L.), which is now removed to the *Materia Medica* by the London College: Reddish-brown, with a peculiar odour; specific gravity 1.019. An ounce is saturated by a drachm of crystals of carbonate of

¹ For farther information on this subject, consult Aikins's *Dictionary of Chemistry*, vol. ii. p. 468, Lond. 1877; and Donovan's *Domestic Economy*, vol. i. 1830, in Lardner's *Cabinet Cyclopædia*.

² Mr. R. Phillips, *Translation of the Pharmacopœia*, 4th ed., p. 51, Lond. 1841.

³ *Lond. Med. Gaz.* new series, vol. ii. for 1838—39, p. 657.

⁴ See Kützing, in the *Répertoire de Chimie*, iii. 263, Paris, 1838.

⁵ See some remarks on these animalcules by Professor Owen, in the *Cyclopædia of Anatomy and Physiology*, ii. 113, Lond. 1839.

⁶ The Edinburgh College states, that "in four fluidounces [of British vinegar] complete precipitation takes place with thirty minims of solution of nitrate of baryta;" but Mr. Phillips (*Lond. Med. Gaz.* Aug. 3, 1839) has shown, that more than three times this quantity of nitrate is required.

soda. No farther precipitation can be effected by the addition of chloride of barium to the vinegar, after ten minims of the solution of the chloride have been added, and the liquor filtered. Its colour is not changed by hydrosulphuric acid.

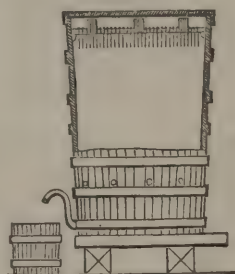
2. *Wine Vinegar (Acetum Gallicum, or French Vinegar, E. D.).*—In wine countries, vinegar is obtained from inferior wines. In France, wine vinegar is prepared in casks, which are placed in a stoved chamber, heated to between 68° and 77° F. Each vat communicates with the air by two apertures. Every eight or ten days the liquor in the vats must be changed. Either red or white wine may be used, but the latter is generally employed.¹

Wine vinegar is of two kinds, *white* and *red*, according as it is prepared from white or red wine. *White wine vinegar* is usually preferred, as it keeps better. That which is made at Orleans is regarded as the best. According to the Edinburgh Pharmacopœia, its density varies from 1.014 to 1.022. A sample of it, examined by Mr. Phillips, had a density of 1.016; and 100 minims of it saturated nearly 14 grains of crystallized carbonate of soda, while an equal quantity of English vinegar, exclusive of the sulphuric acid which it contains, saturated little more than 12 grains; consequently, the French is stronger than the English vinegar by nearly one-sixth.² The constituents of wine vinegar are very similar to those of malt vinegar. It contains a small quantity of bitartrate and sulphate of potash. Both these salts occasion precipitates with barytic solutions; but that produced by the bitartrate is soluble in nitric acid. The Edinburgh College states that “ammonia, in slight excess, causes a purplish muddiness, and slowly a purplish precipitate. In four fluidounces, complete precipitation takes place with 30 minims of solution of nitrate of baryta,” *Ph. Ed.* But Mr. Phillips³ has shown that this quantity of nitrate is more than twice as much as is requisite.

3. *Improved, German, or Quick Method of Vinegar-making.*—As acetification is essentially the oxidation of alcohol, the German chemists have contrived an improved method of effecting it, by which the time necessary to the production of vinegar is greatly curtailed. It consists in greatly enlarging the surface of the liquid exposed to the air.

This is effected by causing a mixture of one part of alcohol at 80 per cent., four to six parts water, 1000 of ferment, honey, or extract of malt, to trickle down through a mass of beech shavings steeped in vinegar, and contained in a vessel called a *Vinegar Generator (Essigbiller)* or *Graduation Vessel*. It is an oaken tub, narrower at the bottom than at the top, furnished with a loose lid or cover, below which is a perforated shelf (colender or false bottom), having a number of small holes, loosely filled with packthread about six inches long, and prevented from falling through by a knot at the upper end. The shelf is also perforated with four open glass tubes, as air vents, each having their ends projecting above and below the shelf. The tub, at its lower part, is pierced with a horizontal row of eight equidistant round holes, to admit atmospheric air. One inch above the bottom is a siphon-formed discharge pipe, whose upper curvature stands one inch below the level of the air-holes in the side of the tub. The body of the tub being filled with beech chips, the alcoholic liquor (first heated to between 75° F. and 83° F.) is placed on the shelf. It trickles slowly through the holes by means of the packthreads, diffuses itself over the chips, slowly collects at the bottom of the tub, and then runs off by the siphon pipe. The air enters by the circumferential holes, circulates freely through the tub, and escapes by the glass tubes. As the oxygen is absorbed, the temperature of the liquid rises to 100° or 104° F., and remains stationary at that point while the action goes on favourably. The liquid requires to be passed three or four times through the cask before acetification is complete, which is in general effected in from twenty-four to thirty-six hours.⁴

Fig. 396.



Vinegar Generator.

(The upper part of the figure represents a vertical section of the tube.)

¹ See Guibourt, *Histoire Abrégée des Drogues Simples*, 3ème édit. ii. 630, Paris, 1836; Ure's *Dictionary of Arts*, p. 3. Lond. 1839; and Donovan, *op. supra cit.* p. 328.

² *Lond. Med. Gaz.* Aug. 3. 1839.

³ *Op. supra cit.*

⁴ For farther details, consult Ure's *Dictionary of Arts*, pp. 4 and 617; M'tscherlich, *Lehrbuch der Chemie*, Bd. i. S. 549, 2te Aufl. Berlin, 1834; and Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 876.

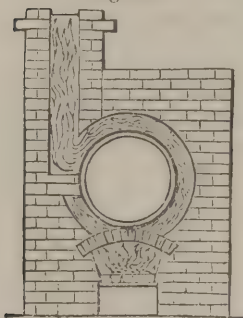
Theory of Acetification.—A remarkable distinction between the acetous and vinous fermentation is, that for the former to be perfectly established, the presence of atmospheric air (or of oxygen) is essential, while for the latter this is not necessary. During the acetous fermentation, the alcohol is converted into acetic acid, by the absorption of atmospheric oxygen. One equivalent or 46 parts of alcohol, with four equivalents or 32 parts of atmospheric oxygen, contain the elements of one equivalent or 51 parts of anhydrous acetic acid, and of three equivalents or 27 parts of water; or one equivalent or 60 parts of hydrous acetic acid, and two equivalents or 18 parts of water, as represented in the following equation, $C^4H^6O^2 + O^1 = 3HO + C^4H^3O^3$ or $2HO + C^4H^3O^3 + HO$.

According to Liebig, however, the transformation of alcohol into acetic acid is not immediate and direct. The atmospheric oxygen first oxidizes part of its hydrogen, forming water and aldehyd ($C^4H^4O^2$); and the latter absorbing oxygen, is converted into acetic acid.

The student will observe that the theory of acetification above given does not account for the ebullition of carbonic acid during the process, and which is generally considered to be an incidental result of continued vinous fermentation, and not essential to the formation of acetic acid.

2. By the Destructive Distillation of Wood.—By the destructive distillation of the hard woods (oak, beech, hornbeam, ash, and birch), in iron cylinders, an impure acid, called Pyroligneous Acid, is obtained. The woods should be dried

Fig. 397.



Section of a Pyroligneous Acid Still.

during several months. The lighter woods, as fir, and old ship timber, do not pay to distil, as the acid product is too weak. Sometimes the still is a cast-iron cylinder, placed horizontally in a furnace, the fire of which plays around the cylinder, as in Fig. 397. Another form of still is used at a large manufactory in the neighbourhood of London. It is a short cylinder of large diameter, placed upright in the furnace. The wood, cut up into convenient lengths, is introduced into wrought-iron canisters, in each of which is a hole, to allow of the escape of volatile matters. By the aid of a crane, these canisters are raised and deposited in the cylindrical still, the top of which is then carefully closed and made air-tight by luting. The still communicates with a large iron pipe which passes successively through two tanks of cold water, in which it is variously convoluted, and terminates in an underground reservoir, where tar and an

acid liquor are deposited. The incondensable products are carbonic acid and some inflammable gases (carbonic oxide, light carburetted hydrogen, and olefiant gas), which escape. When no more volatile matter comes over, the still is opened, and the canisters being removed while still hot, the apertures in them are carefully closed by damp sand, to exclude air.

The tar obtained by the above process yields, on distillation, oil of tar, and a residuum called *English asphalt*, or *pitch*. The acid liquor, which rests on the tar in the reservoir, consists of *acetic acid*, *water*, *tar*, and *pyroxylic spirit*. A light tarry matter usually floats on the top of it. By means of a pump, the acid liquor is raised and introduced into a copper still, where it is subjected to distillation. The first runnings contain pyroxylic spirit. After this has come over, an impure dilute acetic acid, called pyroligneous acid, distils over. The residue in the retort is *English asphalt*, or *pitch*.

The pyroligneous acid thus obtained is mixed with cream of lime, and the mixture evaporated to dryness in shallow wrought-iron pans, when it forms a grayish mass, called *pyrolignite of lime*. If this be submitted to distillation with sulphuric acid, it yields an impure acetic acid, which is used in the manufacture of acetate of lead, and for making carbonate of lead by the Dutch process. If pyrolignite of

lime be mixed with a solution of sulphate of soda, double decomposition is effected, and sulphate of lime and acetate of soda are the products. The latter is repeatedly crystallized until it is colourless, and is then in a fit state for the manufacture of pure concentrated acetic acid. [In some manufactories, the acid liquor, after the separation of the greater part of the tar, by subsidence, is at once neutralized by carbonate of soda, and the crude acetate of soda is obtained by crystallization, and subsequently purified.—ED.]

1. **PYROXYLIC SPIRIT**; *Pyrolygneous Ether*; *Hydrate of Oxide of Methyle*; *Bihydrate of Methyrene*—Sometimes, but improperly, termed *Naphtha*. The first runnings of the distillation of the acid liquor above referred to, are redistilled once or twice, and the product is sold under the name of *pyrolygneous ether*. It is an impure liquor, containing, besides hydrate of the oxide of methyle, acetone and other inflammable liquors. It is employed by chemists as a substitute for spirit of wine for burning in lamps, and by hatters and varnish-makers for dissolving resinous substances. Drs. Babington and Rees¹ have suggested its use for the preservation of subjects for anatomical purposes. The spirit is to be injected into the aorta, the rectum, and the peritoneum. It was tried at the London Hospital, but the smell arising from the spirit was so intolerable, that, even if there were no other objections to its use, this alone would be fatal to it. Pure pyroxylic spirit is obtained by introducing it into a retort with excess of chloride of calcium, and distilling the mixture by a water-bath, as long as volatile matter passes off. A quantity of water, equal to the spirit employed, is then added, and the distillation continued. The product is now pure pyroxylic spirit, carrying along with it a little water, which is removed by a second distillation with quicklime (Liebig). Pure pyroxylic spirit is a very mobile, colourless, inflammable liquid, which has a peculiar odour, somewhat resembling that of alcohol and acetic ether. It boils at 150° F. It dissolves many resins, mixes with most essential oils, and forms crystalline compounds with baryta, lime, and chloride of calcium. Its composition is as follows:—

	Atoms.	Eq.Wt.	Or,	Atoms.	Eq.Wt.
Carbon	2	12	Oxide of Methyle	1	23
Hydrogen	4	4	Water	1	9
Oxygen	2	16			
	—	—	Hydrate of Oxide of Methyle	1	32
Pyroxylic Spirit .	1	32			

Or, $C^2H^3O + HO$.

Methyle (C^2H^3) is the hypothetical radical of pyroxylic spirit.

Oxide of Methyle, or *Methylic Ether* (C^2H^3O) is a colourless gas.

The repeated use of small quantities of pyroxylic spirit caused colicky pains, and acted as an anthelmintic.²

2. **EBLANIN**; *Pyroxanthine*; *Pyroxyline*—This substance was obtained by Scanlan from raw pyroxylic spirit. It is a crystalline substance, of an orange-red colour. Oil of vitriol dissolves it, and assumes a reddish-blue colour. Concentrated hydrochloric acid also dissolves it, and acquires an intense purple colour.

	Atoms.	Eq.Wt.	Per Cent.
Carbon	21	126	75.45
Hydrogen	9	9	5.39
Oxygen	4	32	19.16
	—	—	—
Eblanin	1	167	100.00

PREPARATION OF ACETIC ACID.—The Edinburgh and Dublin Colleges give directions for the preparation of a concentrated solution of acetic acid, which they simply term acetic acid. The London College has removed the *Acidum Aceticum* to the *Materia Medica*, and gives the following note for testing the purity of the commercial article which is described as "*Acidum e ligno igne præparatum purificatum*."

Free of colour, with a very acrid odour; specific gravity 1.048; volatilized by heat. No precipitate thrown down in it on the addition of nitrate of silver or chloride of barium. A piece of silver being digested with it, nothing is thrown down on the subsequent addition of hydrochloric acid. Neither is its colour changed on the addition of hydrosulphuric acid, nor ammonia, nor by ferrocyanide of potassium subsequently to the ammonia. 100 grains are saturated by 87 grains of crystals of carbonate of soda. *Acidum Aceticum Dilutum*, P. L.—Take of Acetic Acid [℥xxiij]; of Distilled Water Oj. Add to the acid as much of the water as may fill a pint measure exactly, and mix. The specific gravity is 1.008. A fluidounce of it is saturated by 57 grains of crystals of carbonate of soda.

The *Edinburgh College* gives the following directions: "Take of Acetate of Lead any convenient quantity; heat it gradually in a porcelain basin, by means of a bath of oil, or fusible

¹ *Guy's Hospital Reports*, Oct. 1839; and *Lond. Med. Gaz.* new series, vol. i. for 1839—40.

² Dierbach, *Neuesten Entdeck. in d. Mat. Med.* Bd. i. S. 314, 2ter Aug. 1837.

metal (8 tin, 4 lead, 3 bismuth) to 320° F.; and stir till the fused mass concretes again; pulverize this when cold, and heat the powder again to 320° , with frequent stirring, till the particles cease to accrete. Add six ounces of the powder to nine fluidrachms and a half of pure sulphuric acid, contained in a glass matrass; attach a proper tube and refrigerator, and distil from a fusible metal-bath, with a heat of 320° , to complete dryness. Agitate the distilled liquid with a grain or two of red oxide of lead to remove a little sulphurous acid; allow the vessel to rest a few minutes, pour off the clear liquor, and redistil. The density should be not above 1.065."

The directions of the *Dublin College* are as follows:—

ACIDUM ACETICUM GLACIALE.—Take of Acetate of Lead, any convenient quantity. Place it in an oven at about the temperature of 300° , until it ceases to lose weight, and, having then brought it by trituration to a fine powder, let it be introduced into a flask or retort, and exposed to an atmosphere of dry muriatic acid gas, until very nearly the whole of it exhibits a damped appearance. The flask or retort being now connected in the usual manner with a Liebig's condenser, let heat be applied by means of a chloride of zinc bath, until the entire of the acetic acid shall have distilled over. The muriatic acid gas should be slowly disengaged from the materials directed in the formula for *Acidum Muriaticum*, using eight ounces of salt for every pound of anhydrous acetate of lead; and, to render it quite dry, it should, before being conducted into the vessel containing the sugar of lead, be made to bubble through oil of vitriol, and then pass through a long tube packed with small fragments of fused chloride of calcium. The specific gravity of this acid is 1065.

ACIDUM ACETICUM FORTE (*Acidum Aceticum*).—Take of Glacial Acetic Acid $\text{f}\overline{\text{3}}\text{vj}$; Distilled Water $\overline{\text{3}}\text{iv}$. Mix. The specific gravity of this acid is 1066.

ACIDUM ACETICUM DILUTUM.—Take of Acetic acid of commerce (sp. gr. 1044) Oj ; Distilled Water Ovij . Mix. The specific gravity of this acid is 1006¹

[The directions of the *U. S. Pharm.* are as follows: Take of Acetic Acid Oj ; Diluted Water Ovij . Mix them. It has sp. gr. 1.004, and 100 grains saturate 7.5 grains of crystallized bicarbonate of potassa.]

The *London College* formerly ordered for the preparation of this acid, Acetate of Soda ℥ij ; Sulphuric Acid $\overline{\text{3}}\text{ix}$; Distilled Water $\overline{\text{3}}\text{ix}$. Add the sulphuric acid, first mixed with the water, to the acetate of soda put into a glass retort, then let the acid distil in a sand-bath. Care is to be taken that the heat, towards the end, be not too much increased.

The proportions of acetate of soda, sulphuric acid, and water, above given, are nearly equal to one equivalent or 137 parts of crystallized acetate of soda, one equivalent or 49 parts of the strongest oil of vitriol (protohydrate of sulphuric acid), and six equivalents or 54 parts of water. The results of the distillation, on this calculation, will be the formation of one equivalent or 72 parts of anhydrous sulphate of soda, and the disengagement of one equivalent or 51 parts of anhydrous acetic acid, and thirteen equivalents or 117 parts of water. The calculated results agree very closely with the actual products. The resulting acid consists of 51 real acetic acid and 114.58 water; so that $117 - 114.58 = 2.42$ of water must remain in the retort with the sulphate of soda. Omitting the water, and treating the acetate of soda as anhydrous, the following equation will represent the chemical changes which ensue, $\text{NaO}, \text{C}^4\text{H}^5\text{O}^3 + \text{SO}^3, \text{HO} = \text{NaO}, \text{SO}^3 + \text{Ac} (\text{C}^4\text{H}^3\text{O}^3) \text{HO}$.

The *Edinburgh College* employs acetate of lead instead of acetate of soda. The salt is first dried to expel the water of crystallization, and the anhydrous salt thus obtained is subjected to distillation along with pure oil of vitriol, with the view, I presume, of obtaining glacial acetic acid. Hydrated acetic acid distils over, and sulphate of lead is left in the retort. To remove any sulphurous acid which may be formed, red oxide of lead is ordered to be added to the acetic acid, by which sulphate and sulphite of lead are formed, and the acetic acid is then to be redistilled.² The *Dublin College* also employs acetate of lead to yield glacial acetic acid. The reactions are similar to those of the *Edinburgh* process.

¹ For farther details, see Thomson's *Chemistry of Organic Bodies*, p. 751, Lond. 1833.

² The process of the *Edinburgh Pharmacopoeia* has been critically examined by Mr. R. Phillips (*Lond. Med. Gaz.* new series, vol. ii. for 1839–40, p. 271). It cannot be denied that several unnecessary refinements have been introduced into it, which render the operation troublesome, wasteful, and expensive. Such are the use of a bath of oil or fusible metal—the addition of red lead—and subsequent redistillation of the acid to get rid of a quantity of sulphurous acid, which, judging from the quantity of red oxide to be used, cannot exceed the $\frac{1}{2000}$ part of the product. Moreover, the whole process is objectionable, on the ground that acid of this strength is not required for medicinal or pharmaceutical purposes.

The distillation of acetic acid is usually effected in glass or earthenware stills. On the large scale, silver condensers are sometimes used.

PROPERTIES.—*Glacial Acetic Acid* is the strongest acetic acid procurable. It crystallizes at 45° F. when we throw into it any particle of solid matter (a crystal of acetic acid answers best), and the thermometer plunged into it rises at the same time from 45° to 51°. These crystals are brilliant, broad flat plates, of a pearly lustre. They melt at a temperature somewhat below 60° F. The sp. gr. of the liquid at 60° is 1.06296.

When crystals of glacial acetic acid are dissolved in water we obtain a solution which, by way of distinction, we may denominate *liquid acetic acid*. The following table, drawn up by Dr. Thomson,¹ shows the specific gravity of various atomic compounds of this acid and water :—

Acid.	Water.	Sp. gr. at 60°.
1 atom . . .	+ 1 atom	1.06296
1	+ 2	1.07060
1	+ 3	1.07084
1	+ 4	1.07132
1	+ 5	1.06820
1	+ 6	1.06708
1	+ 7	1.06349
1	+ 8	1.05974
1	+ 9	1.05794
1	+ 10	1.05439

More recently Mohr² has published the following table, exhibiting the sp. gr. of acetic acid of different strengths :—

Per Cent. of Glacial Acid (C ⁴ H ³ O ³ + Aq.)	Sp. Gr.	Per Cent of Glacial Acid (C ⁴ H ³ O ³ + Aq.)	Sp. Gr.	Per Cent. of Glacial Acid. (C ⁴ H ³ O ³ + Aq.)	Sp. Gr.
100	1.0635	66	1.069	32	1.0424
99	1.0655	65	1.068	31	1.041
98	1.067	64	1.068	30	1.040
97	1.0680	63	1.068	29	1.039
96	1.069	62	1.067	28	1.038
95	1.070	61	1.067	27	1.036
94	1.0706	60	1.067	26	1.035
93	1.0708	59	1.066	25	1.034
92	1.0716	58	1.066	24	1.033
91	1.0721	57	1.065	23	1.032
90	1.0730	56	1.064	22	1.031
89	1.0730	55	1.064	21	1.029
88	1.0730	54	1.063	20	1.027
87	1.0730	53	1.063	19	1.026
86	1.0730	52	1.062	18	1.025
85	1.0730	51	1.061	17	1.024
84	1.0730	50	1.060	16	1.023
83	1.0730	49	1.059	15	1.022
82	1.0730	48	1.058	14	1.020
81	1.0732	47	1.056	13	1.018
80	1.0735	46	1.055	12	1.017
79	1.0735	45	1.055	11	1.016
78	1.0732	44	1.054	10	1.015
77	1.0732	43	1.053	9	1.013
76	1.073	42	1.052	8	1.012
75	1.072	41	1.0515	7	1.010
74	1.072	40	1.0513	6	1.008
73	1.072	39	1.050	5	1.0067
72	1.071	38	1.049	4	1.0055
71	1.071	37	1.048	3	1.004
70	1.070	36	1.047	2	1.002
69	1.070	35	1.046	1	1.001
68	1.070	34	1.045	0	1.000
67	1.069	33	1.044		

¹ First Principles of Chemistry, ii. 135.

² Pharm. Central-Blatt für 1899, S. 840—1.

From these tables it is obvious that density is no criterion of the strength of liquid acetic acid.

The *Acidum Aceticum* of the Edinburgh Pharmacopœia is stated in one part of that work to have a sp. gr. of not above 1.065, in another to have a sp. gr. of not above 1.0685; moreover, in the same work, the density of the acid is said to be increased by [the addition of] 20 per cent. of water. There are, however, some obvious mistakes in these statements.¹ The *Acidum Aceticum* of the London Pharmacopœia has a sp. gr. of 1.048. One hundred grains of it are saturated by eighty-seven grains of crystals of carbonate of soda. Hence it contains 30.8 per cent. of real or anhydrous acetic acid. It is a limpid, colourless liquid, having a pungent but agreeable odour, and an acrid taste. It possesses the usual properties of an acid—such as reddening litmus, causing effervescence with the alkaline or earthy carbonates, and saturating bases. It is volatile, and by heat evolves an inflammable vapour. [The sp. gr. of *U. S. Pharm.* is 1.041.]

CHARACTERISTICS.—*Free acetic acid* is known by its peculiar odour and by its volatility. Its vapour reddens litmus, and fumes with ammonia. It does not occasion any precipitate with lime-water, solutions of the barytic salts, or a solution of nitrate of silver. It forms with potash a very deliquescent salt. Concentrated acetic acid does not cause effervescence when marble is dropped into it, unless water be added. The *neutral acetates* are all soluble, save those of molybdenum and tungsten. The acetates of silver and protoxide of mercury are slightly soluble. The acetates are known by the acetic odour which they emit on the addition of sulphuric acid and the application of heat, and by the white lamellar and pearly precipitates which many of them produce with the nitrate of silver and the proto-nitrate of mercury. They redden solutions of the sesquisalts of iron (forming *sesquiacetate of iron*). All the acetates are decomposed by heat, and give results which vary somewhat according to the nature of the base. Some of the acetates, as those of potash, lead, and copper, evolve, when heated, an inflammable fluid; called *acetone* or *pyroacetic spirit*, whose composition is $C^9H^3O^9$.

COMPOSITION.—Anhydrous or real acetic acid (\bar{Ac}) consists of carbon, hydrogen, and oxygen, in the following proportions:—

	Atoms.	Eq. Wt.	Per Cent.	Prout.	Berzelius.
Carbon	4	24	47.06	47.05	46.83
Hydrogen	3	3	5.88	5.83	6.35
Oxygen	3	24	47.06	47.07	46.82
Anhydrous Acetic Acid 1		51	100.00	100.00	100.00

The *Acidum Aceticum* of the pharmacopœias is a compound of Anhydrous or Real Acetic Acid and Water. Prepared according to the London Pharmacopœia, 100 grs. of it contain 30.8 grs. of real acetic acid; or very nearly one equivalent of real acetic acid, and 13 equivalents of water.

	Atoms.	Eq. Wt.	Theory.	Experiment.
Anhydrous acetic acid	1	51	30.35	30.8
Water	13	117	69.65	69.2
<i>Acidum Aceticum, Ph. L.</i> 1		168	100.00	100.0

Owing to the errors before alluded to in the statements of the Edinburgh College, it is impossible to estimate, correctly, the strength of the acid intended to be obtained by the process given in the Edinburgh Pharmacopœia. If, however, the acid had a sp. gr. of 1.068, and 100 minims of it required 216 grs. of crystallized carbonate of soda to saturate it, as stated by the College, its percentage quantity of real acetic acid would be 78.65.

ACETOMETRY.—The strength of acetic acid is best determined by ascertaining the quantity of alkaline carbonate which is required to saturate a given quantity of acid. Crystallized carbonate of soda, or crystallized bicarbonate of potash, are salts

¹ See Mr. R. Phillips, in the *London Medical Gazette*, new series, vol. ii. for 1838–9, p. 658.

of uniform constitution, and may be employed for this purpose. Every 144 grs. of the crystallized carbonate of soda, or 101 grs. of crystallized bicarbonate of potash, are equal to 51 grs. of real acetic acid, or 60 grs. of glacial acetic acid. Marble or carbonate of lime is objectionable, since concentrated acetic acid will not decompose it without the addition of water. It has been already shown that specific gravity is no criterion of the strength of the hydrated acid; since two acids of very unequal strength may have the same density. Moreover, the foreign matters (*i. e.* mucilage and alcohol) contained in vinegar, alter the density of this fluid, though they do not affect its acetometrical strength. The acetometrical method employed by the Excise is that recommended by Messrs. J. and P. Taylor,¹ and consists in estimating the strength of the acid by the sp. gr. which it acquires when saturated by hydrate of lime. Acid which contains 5 per cent. of real acetic acid, is equal in strength to the best malt vinegar, called by the makers No. 24, and is assumed as the standard of vinegar strength, under the denomination of *proof vinegar*.² Acid which contains 40 per cent. of real acetic acid, is, therefore, in the language of the revenue, *35 per cent. over proof*; it is the strongest acid on which duty is charged by the Acetometer. Vinegars, which have not been distilled, contain mucilage, and require an allowance for the increase of weight from this cause; hence in the Acetometer sold by Bate, a weight marked M is provided, and is used in trying such vinegars.³ As the hydrate of lime employed causes the precipitation of part of the mucilaginous matter in the vinegar, it serves to get rid of part of the difficulty above referred to.

IMPURITIES.—The presence of sulphuric, hydrochloric, or nitric acid—of metallic matter—and of acrid substances in acetic acid, may be detected by the same methods as have already been pointed out for vinegar. Sulphurous acid is recognized by the white precipitate (*sulphate of lead*) produced on the addition of peroxide of lead. The presence of lead in acetic acid is known by the yellow precipitate (*iodide of lead*) occasioned by the addition of iodide of potassium.

PHYSIOLOGICAL EFFECTS.—Before proceeding to notice the operation of acetic acid on vegetables and animals, it may be useful to point out such of its effects on *dead organic matters* as have reference to its influence on living beings. In the first place, it is a well-known and powerful antiseptic, and is employed, partly on this account, in the ordinary operation of pickling, and in the preservation of animal food, and of anatomical preparations. The impure acetic acid obtained in the distillation of wood acts more efficaciously in this respect than the pure acid, on account of the creasote which it contains. Secondly, the action of acetic acid on albumen, fibrin, and blood-disks, deserves especial notice. Liquid albumen (as serum of blood and white of egg) is not coagulated by the ordinary acetic acid of the shops. Coagulated albumen is readily dissolved by it with the evolution of nitrogen, especially with the assistance of heat. Fibrin, as muscle or the crassamentum of the blood, is also dissolved by it; the solution, by evaporation, yields a gelatiniform mass. Caseine is coagulated by it. It changes the form of the red particles of frog's blood, and dissolves part of the red colouring matter.⁴ It is an excellent solvent of gelatine, as well as of gelatinous tissue. Diluted and mixed with mucus, it acts as a digestive fluid.⁵

a. On Vegetables.—Distilled vinegar is ranked, by Achard, among vegetable poisons.⁶

β. On Animals generally.—Concentrated acetic acid acts as a caustic poison to dogs. It causes blackening of the mucous lining of the stomach, analogous to that produced by sulphuric acid.⁷ Four or five ounces of common vinegar proved fatal to dogs in ten or fifteen hours, when vomiting was prevented by tying the œsophagus.

¹ *Quarterly Journal of Science*, vi. 255.

² 58 Geo. III. c. 65.

³ See *Description of the Acetometer for determining the Strengths of Acetic Acid, made for the Revenue of the United Kingdom*, by R. B. Bate, 21, Poultry, London.

⁴ Müller's *Physiology*, p. 106.

⁵ Müller, *op. cit.* p. 545.

⁶ De Candolle, *Phys. Végét.*

⁷ Orfila, *Journ. de Chim. Méd.* t. vii. p. 449.

gus.¹ Injected into the veins, vinegar does not appear to act energetically. Viborg threw two ounces and a half of wine vinegar into the jugular vein of a horse; the next day the animal was well.² Analogous results have been obtained by Courten and Hertwich (quoted by Wibmer), and by Pommer.³

The impure acetic acid obtained by the distillation of wood has been usually regarded as possessing much more activity than pure acetic acid of the same strength, in consequence of the presence of empyreumatic oil. An extensive series of experiments have been made with it on amphibians, birds, and mammals, by Berres, Kerner, and Schubarth. From these it appears that pyroligneous acid is a caustic poison; and that it destroys some of the lower animals, viz.: amphibians, merely by contact with the external skin. Large doses affect the cerebro-spinal system, and cause giddiness, insensibility, paralysis, and convulsions. A very constant effect of it was an affection of the windpipe and lungs. The acid was detected by its odour, in the blood and secretions.⁴

γ. On Man.—In the concentrated state, acetic acid is an irritant and corrosive poison. Its chemical influence depends principally on its power of dissolving fibrin, albumen, and gelatine, as before mentioned, by which it is enabled to dissolve many of the animal tissues. Applied to the skin, it acts as a rubefacient and vesicant. Only one fatal case of poisoning by its internal use is known. The patient (a girl) appeared to be intoxicated, complained of acute pain, and was violently convulsed.⁵ Swallowed in a very dilute form, and in moderate doses, it proves refreshing, allays thirst, diminishes preternatural heat, lowers the pulse, and augments the urine. In its general effects, therefore, it appears to lower the powers of life, and to prove antiphlogistic. It agrees in its operation with the diluted mineral acids. Its local operation is astringent. Used moderately, it assists the digestive process, and is, therefore, taken as a condiment. It is in repute with young ladies for diminishing obesity. "Every one knows," says Giacomini,⁶ "that when habitually taken, it produces leanness, from a sort of languor of the digestive process." The following is a case, quoted by this author, from Portal:—

"A few years ago, a young lady, in easy circumstances, enjoyed good health; she was very plump, had a good appetite, and a blooming complexion. She began to look upon her plumpness with suspicion; for her mother was very fat, and she was afraid of becoming like her. Accordingly, she consulted a woman, who advised her to drink a small glass of vinegar daily: the young lady followed her advice, and her plumpness diminished. She was delighted with the success of the remedy, and continued it for more than a month. She began to have a cough, but it was dry at its commencement, and was considered as a slight cold, which would go off. Meantime, from dry it became moist; a slow fever came on, and a difficulty of breathing; her body became lean, and wasted away; night-sweats, swelling of the feet and of the legs succeeded, and a diarrhœa terminated her life. On examination, all the lobes of the lungs were found filled with tubercles, and somewhat resembled a bunch of grapes."

It is said that the long-continued use of it, in full doses, will induce chronic diseases of the gastro-intestinal mucous membrane; and Morgagni says it has even given rise to scirrhus of the pylorus.

Vinegar may be taken in considerable quantity at one time without inconvenience. Dr. Christison⁷ knew a case in which eight ounces were swallowed without injury.

The vapour of strong acetic acid is very pungent and irritating. The long-continued inhalation of acetic vapours by the workmen employed at vinegar-works, is said by Sundelin⁸ to be injurious to the lungs, and to bring on chronic inflammation of these organs. On inquiry among the workmen of a large vinegar manufactory, I find the notion of the injurious influence of the vapour generally repudiated. Both at these works, and at a pyroligneous acid manufactory, the workmen appeared in excellent health.

USES.—The uses of acetic acid and vinegar to the medical practitioner are of two kinds—medicinal and pharmaceutical.

¹ Orfila, *Journ. de Chim. Méd.* t. vii. p. 449.

² Wibmer, *Die Wirkung der Arzneimittel, und Gifte*, Bd. i. S. 11.

³ Christison, *Treatise on Poisons*.

⁴ Wibmer, *op. supra cit.*

⁵ Orfila, *Journ. Chim. Méd.* t. ii.

⁶ *Lond. Med. Gaz.* new series, vol. ii. for 1835—9, p. 175.

⁷ Christison, *Treatise on Poisons*.

⁸ *Handb. d. Heilmittellehre*.

1. MEDICINAL.—Taken internally, common vinegar, or acetic acid properly diluted, is used for various purposes: the most important of these are to allay febrile heat by its refrigerant qualities; to diminish inordinate vascular action; to relieve certain affections of the brain supposed to depend on or be connected with venous congestion; and to act by its chemical properties of an acid. Thus, in *fevers*, whether simple or eruptive, but especially in those varieties commonly denominated putrid and bilious, vinegar (more or less diluted with water) is a most refreshing drink, allaying thirst, and diminishing excessive heat. In *hemorrhages*, as from the nose, lungs, stomach, or uterus, it is particularly beneficial by its refrigerant, sedative, and astringent qualities. It diminishes excessive vascular action, and promotes contraction of the bleeding vessels. As a local astringent, it is injected into the nose in epistaxis, and is used as a wash in profuse hemorrhoidal discharges. The benefit obtained by the application of vinegar and water to the abdomen, vulva, and thighs, in uterine hemorrhages, arises principally from the cold produced. In *phthisis pulmonalis*, vinegar, diluted with water, is sometimes serviceable as a palliative, by its refrigerant qualities: it relieves the hectic symptoms, diminishes or puts a stop to the night-sweats, checks bronchial hemorrhage, and prevents diarrhœa. In *mania*, it has been recommended as a means of allaying cerebral excitement. In *poisoning by opium*, it is used as a counter-poison; but as acetic acid forms very soluble, and, therefore, powerful compounds with morphia, it ought not to be exhibited until the contents of the stomach have been evacuated. In poisoning by the alkalies and their carbonates, and by lime, vinegar is the safest and most efficacious acidulous substance that can be administered. In diseases attended with *phosphatic deposits* in the urine, it may be advantageously used either as a medicine or condiment. As an adjunct to the acetate of lead, acetic acid is recommended by Dr. A. T. Thomson, to prevent the formation of carbonate of lead, which is more apt to produce lead colic than the acetate. In *scurvy*, acetic acid has been found serviceable. *Clysters containing vinegar* have been employed for the purpose of provoking alvine evacuations in obstinate constipation and strangulated hernia; of expelling the small round worm (*Ascaris vermicularis*); of checking uterine and intestinal hemorrhage; and of relieving inflammation or congestive conditions of the brain.

As a stimulant, disinfectant, and antiseptic, diluted acetic acid is used in gangrenous and other ill-conditioned ulcers. For these purposes, crude pyroligneous acid is more efficacious than ordinary vinegar, on account of the creasote and other substances which it contains. In ulceration of the throat, in scarlatina, and in cynanche, gargles containing acetic acid or vinegar are sometimes used with good effect. Acetic collyria are useful as mild astringents in chronic ophthalmia, and for removing lime-dust adhering to any part of the globe or lid of the eye. Sponging the face, trunk, or extremities, with cold or tepid vinegar and water, usually proves refreshing and grateful in febrile disorders with a hot skin. It diminishes preternatural heat, promotes the cutaneous functions, and operates as a beneficial stimulant to the nervous system. Fomentations containing vinegar are used in bruises and sprains.

The concentrated acetic acid, known in the shops as Beaufoy's, is a valuable remedy for the cure of the different forms of porrigo, popularly called ringworm or scalled-head. Its application, which may be effected by means of a piece of lint wrapped around a wooden stick, causes acute but temporary pain, redness of the skin, and whitening of the abraded spots. One or two applications are usually sufficient to effect a cure. Strong acetic acid is also employed as a caustic to destroy corns and warts. It has been proposed as a speedy means of exciting rubefaction and vesication, and for this purpose blotting-paper or cambric, moistened with the acid, has been applied to the neck in cases of croup.

ADMINISTRATION.—Vinegar is used as a condiment *ad libitum*. Medicinally, it is given in doses of from $\text{f}\text{ʒj}$ or $\text{f}\text{ʒij}$ to $\text{f}\text{ʒss}$. As an enema, $\text{f}\text{ʒj}$ or $\text{f}\text{ʒij}$ have been used. A refrigerant drink in fevers is made by adding $\text{f}\text{ʒj}$ or $\text{f}\text{ʒij}$ of vinegar to a quart of water. A vinegar-wash is prepared by mixing $\text{f}\text{ʒij}$ of vinegar and $\text{f}\text{ʒv}$ of water.

ANTIDOTES.—In poisoning by strong acetic acid, the treatment is the same as that for poisoning by other acids. (See *Acidum Sulphuricum*.)

1. ACETUM DESTILLATUM, E. [U. S.]; *Distilled Vinegar*.—The Edinburgh is the only British college that gives directions for the preparation of this liquid.

They are as follows: "Take of Vinegar (French, by preference) eight parts; distil over with a gentle heat six parts; dilute the product, if necessary, with distilled water till the density is 1.005."

The first portions which distil over are alcohol, acetic ether, water, and a little acetic acid. Thus prepared, distilled vinegar has a yellowish tint, and contains, besides acetic acid and water, a little alcohol, acetic ether, and an organic substance called mucilage. Hence, when it is saturated with alkalis, the solution becomes brown by heat, and deposits a dark-coloured substance, probably arising from the decomposition of the mucilage.

Its density is stated to be 1.005; and one hundred minims of it neutralize eight grains of crystallized carbonate of soda, indicating the percentage quantity of real acid to be 3.07¹. In order to prevent the distilled vinegar from acquiring a metallic impregnation, the head of the still and the worm or condensing pipe should be of glass or earthenware. I was informed at one vinegar works that a silver worm was employed.

ACETUM GALLICUM.—*French Vinegar* is thus enumerated in the *Materia Medica* of the Pharmacopœias of Edinburgh and Dublin.

2. ACIDUM ACETICUM AROMATICUM, E.—(Rosemary, and Origanum, of each 3j, dried; Lavender, dried, 3ss; Cloves, bruised, 3ss; Acetic Acid Oiss. Macerate for seven days, strain and express strongly, and filter the liquor.)—In the former Edinburgh Pharmacopœia, there was contained, under the same name, a somewhat similar but weaker preparation, made with *diluted* acetic acid (*i. e.* distilled vinegar), in imitation of the celebrated *Marseilles Vinegar* or *Vinegar of the Four Thieves*² (*Vinaigre des Quatre-Voleurs; Acetum quatuor Furum*), once supposed to be a prophylactic against the plague and other contagious diseases. It was a very useless preparation. In the present Edinburgh Pharmacopœia, concentrated acetic acid has been substituted for distilled vinegar, and Origanum for Sage. It is now a pungent perfume, and may be used as a substitute for *Henry's Aromatic Vinegar*. But it appears to me to be a very unnecessary preparation.

The *Acetum aromaticum*, or *Aromatic Vinegar* of the shops, is made in imitation of Henry's Aromatic Vinegar. At Apothecaries' Hall, it is prepared by dissolving the Oils of Cloves, Lavender, Rosemary, and Acorus Calamus, in crystallizable Acetic Acid. It is a very volatile and corrosive preparation, and requires to be kept in carefully stoppered bottles. Some manufacturers add camphor. The addition of water to it causes the precipitation of the greater part of the camphor. It is a much employed pungent perfume, whose vapour is snuffed up the nostrils, to produce a powerful excitant impression, in fainting, languor, headache, and nervous debility. For this purpose it is dropped on sponge, which is preserved in smelling-bottles or *vinaigrettes*. It is also used for the purpose of correcting unpleasant odours, which it does, not by destroying, but by disguising them. An *extemporaneous aromatic vinegar* may be prepared by putting into a stoppered bottle f3j of acetate of potash, three drops of some essential oil (as Lavender or Lemon), and twenty drops of oil of vitriol.

¹ See Mr. R. Phillips, in *London Medical Gazette*, new series, vol. ii. for 1838—9, p. 658; and vol. ii. for 1839—40, p. 271.

² The repute of this preparation as a prophylactic in contagious fevers, is said to have arisen from the confession of four thieves, who, during the plague of Marseilles, plundered the dead bodies with perfect security, and, upon being arrested, stated, on condition of their lives being spared, that the use of aromatic vinegar had preserved them from the influence of contagion. It is on this account sometimes called "*Le Vinaigre des quatre Voleurs*." It was, however, long used before the plague of Marseilles, for it was the constant custom of Cardinal Wolsey to carry in his hand an orange, deprived of its contents, and filled with a sponge which had been soaked in vinegar impregnated with various spices, in order to preserve himself from infection, when passing through the crowds which his splendour or office attracted. The first plague raged in 1649, whereas Wolsey died in 1531. (Paris, *Pharmacologia*, 6th edit. vol. ii. p. 18, Lond. 1825.)

3. **ACIDUM ACETICUM CAMPHORATUM**, E. D.—(Camphor $\mathfrak{z}\text{ss}$; Acetic Acid $\mathfrak{f}\mathfrak{z}\text{viss}$. Pulverize the camphor with the aid of a little rectified spirit, and dissolve it in the acid, *E.*)—(Camphor $\mathfrak{z}\mathfrak{j}$; Rectified Spirit $\mathfrak{z}\mathfrak{j}$; Strong Acetic Acid $\mathfrak{z}\mathfrak{x}$. Reduce the camphor to powder by trituration with the spirit: then add the acid and dissolve, *D.*)—This preparation is an official substitute for *Henry's Aromatic Vinegar*. The spirit is used merely to assist in reducing the camphor to powder. Camphorated acetic acid is exceedingly pungent and corrosive. Its vapour is snuffed up the nostrils as a powerful stimulant in syncope. It is never used internally.

4. **OXYMEL**, L. D.; *Syrupus Aceti*, E.; *Oxymel Simplex*, or *Simple Oxymel*.—(The *London College* directs of Honey $\mathfrak{H}\text{v}$; Acetic Acid $\mathfrak{z}\text{vij}$; Distilled Water $\mathfrak{z}\text{viij}$. Mix the acid added to the water with the honey made hot.—The *Dublin College* orders of Honey, by weight, $\mathfrak{H}\mathfrak{j}$; Acetic Acid of Commerce, sp. gr. 1.044, $\mathfrak{z}\mathfrak{iij}$. Mix the acid with the honey previously heated, *D.*—The *Edinburgh College* substitutes sugar for honey: Take of Vinegar, French in preference, $\mathfrak{f}\mathfrak{z}\mathfrak{x}\mathfrak{j}$; Pure Sugar $\mathfrak{z}\mathfrak{xiv}$. Boil them together.)—It is employed as a detergent and pectoral. It is frequently added to gargles; but is more commonly used as an expectorant in slight colds and coughs. Diffused through barley-water, it forms an agreeable refrigerant drink in febrile and inflammatory complaints. It is sometimes used as a vehicle for other medicines. Dose from $\mathfrak{z}\mathfrak{j}$ to $\mathfrak{z}\text{ss}$ or $\mathfrak{z}\mathfrak{j}$.

PHARMACEUTICAL USES.—Vinegar or acetic acid is employed for extracting the virtues of various medicinal substances, as Squills, Opium, Colchicum, and Cantharides; the solutions are called *Medicated Vinegars (Acetica)*, or by the French pharmacologists, *Oxéolés* (from $\alpha\acute{\omicron}\varsigma$, vinegar). A small quantity of spirit is usually added to them for the purpose of preventing the decomposition of the vinegar, and, in consequence of this, a small portion of acetic ether is generated. They are usually prepared by maceration. The preparations into the composition of which acetic acid and honey enter, are called *Oxymels (Oxymellites)*, or the *Acid Mellites*. Acetic acid is employed also in the manufacture of the salts called *Acetates*. It is a powerful solvent of the gum-resins, and is used, on this account, in the preparation of the *Emplastrum Ammoniæ*. Lastly, distilled vinegar is used in the preparation of Cataplasma Sinapis, Ceratum Saponis, Linimentum Æruginis, and Unguentum Plumbi compositum.

308. **ACIDUM CITRICUM**, L. E. D. [*U. S.*].—**CITRIC ACID.**

HISTORY.—This acid was first procured in the solid state by Scheele, in 1781. It is sometimes termed the *Concrete Acid of Lemons*.

NATURAL HISTORY.—Citric acid is peculiar to the vegetable kingdom. It is found in many acid juices of fruit usually free, but sometimes in combination with either potash or lime. Besides the fruits of the genus *Citrus*, it is found, with little or no malic acid, in the fruits of Dulcamara, Dog-rose, Cranberry, Bird-cherry, and Whortleberry. Mixed with an equal quantity of malic acid, it is found in the Gooseberry, Red-currant, Strawberry, Raspberry, and Cherry. In the Tamarind, it exists with both malic and tartaric acids.

PREPARATION.—The *Edinburgh College* alone gives directions for the preparation of this acid.

The *London College*, in its former *Pharmacopæia*, ordered of Lemon Juice Oiv; Prepared Chalk $\mathfrak{z}\text{ivss}$; Diluted Sulphuric Acid $\mathfrak{z}\text{xxviiss}$; Distilled Water Oij. Add the Chalk gradually to the Lemon Juice made hot, and mix. Set by, that the powder may subside; afterwards pour off the supernatant liquor. Wash the Citrate of Lime frequently with warm water. Then pour upon it the diluted Sulphuric Acid and the Distilled Water, and boil for a quarter of an hour. Press the liquor strongly through linen, and strain it; evaporate the strained liquor with a gentle heat, and set it by, that crystals may be formed. Dissolve the crystals, that they may be pure, again and a third time in water, and as often strain the solution, boil down, and set it aside.

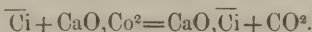
The *Edinburgh College* employs the same quantity of Lemon Juice and Chalk (or of the latter a sufficiency), and "Diluted Sulphuric Acid $\mathfrak{f}\mathfrak{z}\text{xxvii}$, or in the same proportion to the chalk

required."¹ The lemon juice is to be boiled twice, and allowed to rest once before the chalk is added. After the sulphuric acid has been added, the filtered liquor is to be tested with a solution of nitrate of baryta, and if the precipitate thereby obtained be not almost "entirely soluble in nitric acid," more citrate of lime is to be added [to saturate the great excess of sulphuric acid]

The *Dublin College* gives no process for the preparation of this acid.

The juice of lemons and limes is imported for citric acid manufacturers, in pipes and hogsheads. It is saturated with chalk or whiting in a large vat. By this means a citrate of lime is formed. This is precipitated, while the carbonic acid of the chalk escapes, and the mucilage of the juice for the most part remains in solution.

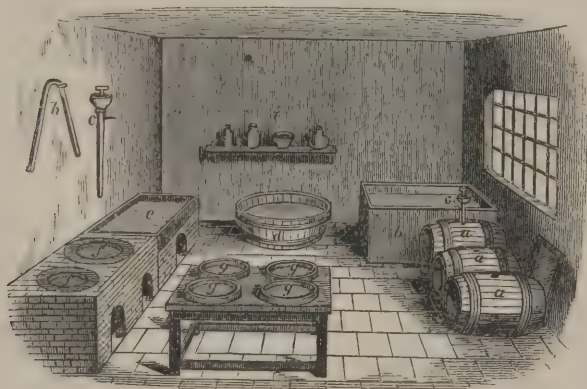
MATERIALS.	COMPOSITION.	PRODUCTS.
Chalk	{ Carbonic Acid	Carbonic Acid Gas.
	{ Lime	
Lemon Juice . .	{ Water, Mucilage, &c.	Water, Mucilage, &c.
	{ Citric Acid	Citrate of Lime.



The supernatant liquor is then drawn off, and the citrate of lime is passed through a sieve and frequently washed with warm water, until the mucilage and other soluble impurities are for the most part got rid of. Sulphuric acid, diluted with water, is afterwards added: sulphate of lime separates, and citric acid is left in solution, $\text{CaO}, \overline{\text{Ci}} + \text{SO}^2 = \text{CaO}, \text{So}^3 + \overline{\text{Ci}}$.

The clear solution is then evaporated in leaden boilers, and the concentrated solution set aside to crystallize. The crystals are afterwards purified by re-solution and re-crystallization.²

Fig. 398.



Citric Acid Manufactory.

- | | |
|--|---|
| <p><i>a, a, a.</i> Casks of Lemon Juice.
 <i>b.</i> Wooden Vat for saturating the juice with chalk.
 <i>c, c.</i> Copper Pumps.
 <i>d.</i> Decomposing Tub for the citrate of lime and sulphuric acid.
 <i>e.</i> Leaden boiler.</p> | <p><i>f, f.</i> Finishing Leaden Boilers.
 <i>g.</i> Crystallizing Pans.
 <i>h.</i> Leaden Siphon for running off the waste liquor from the vat <i>b</i>.
 <i>i.</i> Chemical Tests.
 <i>k.</i> Movable Strainer for clearing the mother liquors.</p> |
|--|---|

PROPERTIES.—Citric acid crystallizes in colourless, odourless, very sour, transparent, short, rhomboidal prisms, whose extremities are terminated by four trapezoidal faces, and which belong to the right prismatic system.³ Crystallized

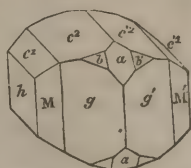
¹ The Edinburgh College employs half an ounce of diluted sulphuric acid less than the quantity formerly ordered by the London College; whereas it ought to have been increased by eight ounces, in consequence of the diluted sulphuric acid of the Edinburgh Pharmacopœia being weaker than that of the London Pharmacopœia (Mr. R. Phillips, *Lond. Med. Gaz.* new series, vol. ii. 1838—9, p. 690).

² For farther details, consult Parke's *Chemical Essays*, 2d edit. i. 539, 1523.

³ Brooke, *Annals of Philosophy*, new series, vi. 119.

citric acid becomes damp by exposure to a moist atmosphere, though Dumas and other French chemists, state it to be unalterable by the air. According to Vauquelin, it is soluble in 75 parts of cold and 50 of boiling water. The solution is strongly acid, and becomes mouldy by keeping. Crystallized citric acid is much less soluble in alcohol than in water. Its sp. gr. is 1.617. Heated with potash, it is converted into oxalic and acetic acids and water. Treated with oil of vitriol, it evolves sulphurous acid, carbonic acid, carbonic oxide, acetic acid, and water. Heated with nitric acid, it becomes oxalic acid.

Fig. 399.



Crystal of Citric Acid.

According to Crasso, crystallized citric acid, when exposed to heat, exhibits four stages of decomposition. During the first, the water of crystallization alone is given off, and the residue contains unaltered citric acid. The second stage is characterized by white vapours, and the production of acetone, carbonic oxide, and carbonic acid, while the residue consists of hydrated aconitic acid ($C^3HO^3 + Aq.$), which is the true pyrocitric acid. In the third stage, the aconitic acid, not being volatile, is itself decomposed, yielding carbonic acid and an oily liquid which soon crystallizes. This is the pyroaconitic acid, the citricic of Baup, for which Crasso proposes the name of itaconic acid ($C^5H^2O^3 + HO$). This acid, when heated, yields citraconic acid ($C^5H^2O^3 + HO$), the citribic acid of Baup. In the fourth period empyreumatic oil is produced, and a voluminous coal remains behind.¹

CHARACTERISTICS.—When added in excess to lime-water, no precipitate is produced. “When a few drops of solution of citric acid are added to lime-water, a clear liquid results, which, when heated, deposits a white powder, soluble in acids without effervescence” (Liebig). It does not yield a crystalline precipitate when added in excess to a solution of carbonate of potash. It forms, with barytic water, a white precipitate (*citrate of baryta*). With a solution of acetate of lead it also furnishes a white precipitate (*citrate of lead*), soluble in ammonia, which forms with it a double salt (*ammoniacal citrate of lead*). Added to a solution of nitrate of silver it produces a white precipitate (*citrate of silver*), which, when heated, becomes brown, froths up, deflagrates, discharges white fumes, and leaves an abundant, ash-gray, coarsely fibrous, crumbly residue, which by heat becomes pure silver.

COMPOSITION.—The following is the composition of crystallized citric acid:—

	Atoms.	Eq. Wt.	Per Cent.	Dumas.	Prout.	Ure.
Carbon	4	24	35.8	36.28	34.28	33.00
Hydrogen	3	3	4.5	4.45	4.76	4.63
Oxygen	5	40	59.7	59.27	60.96	62.37
Citric Acid crystallized by cooling a solution saturated at 212°	1	67	100.0	100.00	100.00	100.00

Crystallized citric acid of commerce contains, however, somewhat more oxygen and hydrogen (elements of water) than the above. According to Berzelius, hypothetical dry citric acid is composed of $C^4H^2O^4 (=58)$; and, therefore, the acid, crystallized by cooling, consists of $\bar{C}i + Aq.$ ($58 + 9 = 67$), and the commercial acid of $\bar{C}i + 1\frac{1}{2}Aq.$ ($58 + 12 = 70$).

But Liebig² regards the hypothetical dry citric acid as composed of $C^{12}H^5O^{11} (=165)$. On this supposition, the acid, crystallized by cooling, is composed of $\bar{C}i + 3HO + Aq.$ ($165 + 36 = 201$); and the commercial crystals of $\bar{C}i + 3HO + 2Aq.$ ($165 + 45 = 210$). On this view of its constitution, citric acid is a tribasic acid; that is, it combines with three equivalents of base; its equivalent weight being three times the amount assumed in the above tables.

PURITY.—Powdered citric acid is sometimes adulterated with powdered tartaric

¹ Crasso, quoted by Liebig, in Turner's *Elements of Chemistry*, 7th edit.

² Turner's *Elements of Chemistry*, 7th edit.

acid. The fraud may be readily detected by dissolving the suspected acid in a small quantity of water, and adding cautiously to it a solution of carbonate of potash, taking care that the acid be in excess. If any tartaric acid be present, a white crystalline precipitate (*bitartrate of potash*) is formed. The directions of the London and Edinburgh Colleges for ascertaining the purity of the acid are as follows:—

This acid is soluble in water; what is precipitated from the solution by acetate of lead is dissolved by nitric acid. No salt of potash, except the tartrate, is precipitated by solution of citric acid. It is totally dissipated in the fire. (*Ph. Lond.*)

The solubility of the plumbeous precipitate in nitric acid shows the absence of sulphuric acid or a sulphate, although a salt of baryta would be a better test.

A solution in four parts of water is not precipitated by carbonate of potash; when incinerated with the aid of the red oxide of mercury, no ash is left, or a mere trace. (*Ph. Ed.*)

The elements of citric acid (viz. oxygen, hydrogen, and carbon) are dissipated by a red heat. But this dissipation is promoted by agents (*ex.* red oxide of mercury) capable of supplying oxygen without leaving any fixed residuum. [When the acid is slowly heated in air, it melts, burns with a yellowish flame, and leaves but a small residue of carbon. When warmed with concentrated sulphuric acid, it is not blackened, but acquires a yellowish colour.—*Ed.*]

PHYSIOLOGICAL EFFECTS.—Orfila¹ ranks citric acid among the irritant poisons; but Drs. Christison² and Coindet gave drachm doses of it to cats without observing that the animals suffered any inconvenience therefrom. The effects of large doses of this acid on man I am not acquainted with. Small quantities of it, dissolved in water, form an agreeable beverage, which allays thirst, diminishes preternatural heat, checks profuse sweating, and promotes the secretion of urine. Vogt³ considers it to act more powerfully on the skin, and less so on the alimentary canal and urinary organs, than tartaric acid. In its action on the skin it agrees with acetic acid. The continued employment of it, as well as of other acids, disturbs the functions of the digestive organs.⁴ •

USES.—Citric acid is employed in medicine as a substitute for lemon juice, in the preparation of refrigerant drinks and effervescing draughts, and as antiscorbutic, anti-narcotic, and anti-alkaline. (See *Lemon Juice*.)

1. ARTIFICIAL LEMON JUICE.—This is prepared by dissolving Citric Acid ℥viii ss , in Water ℥xxxvj , and flavouring with a few drops of Essence of Lemons. This is less apt to undergo decomposition than the genuine juice, for which the artificial juice may be employed in the preparation of cooling beverages.

2. EFFERVESCING CITRATES.—Citric acid, with the alkaline carbonates, is frequently employed in the preparation of effervescing draughts. The following are the relative proportions of acid and base required to form a neutral compound:—

20 grains of Commercial Crystals of Citric Acid are saturated by about—

Crystallized Bicarbonate of Potash	29 grs.
Carbonate of Potash of Commerce	24 “
Hydrated Sesquicarbonate of Ammonia	17 “
Crystallized Carbonate of Soda	41 “
Sesquicarbonate of Soda of Commerce	24 “

The most agreeable effervescing citrate is that prepared with bicarbonate of potash, flavoured with tincture of orange-peel and syrup (see *Potassæ Citras*, Vol. I.) The carbonates of soda are rarely employed with citric acid.

309. ACIDUM TARTARICUM, L. E. D. [U. S.].—TARTARIC ACID.

HISTORY.—Tartaric acid was first procured in a separate state by Scheele, in 1770. It is sometimes termed the *crystallized acid of tartar*.

¹ *Toxicologie Générale*.

² *Pharmakodyn.* ii. 72, 2te Aufl.

² Christison, *On Poisons*, 3d edit. p. 208.

⁴ For some further observations on its effects, see the article *Lemon Juice* in a subsequent part of this work.

NATURAL HISTORY.—It is peculiar to the vegetable kingdom. In the *free* state it exists in tamarinds, grapes, the pine-apple, and pepper. It is also found native in combination with bases: thus *bitartrate of potash* exists in tamarinds, grapes, and mulberries, and *tartrate of lime* in the fruit of *Rhus typhinum*.

PREPARATION.—The London and Dublin Colleges have placed this acid among the articles of *Materia Medica*. No formula is given for its preparation. The process of the Edinburgh Pharmacopœia is as follows:—

Take of Bitartrate of Potash ℥iv; Boiling Distilled Water Cong. iiss; Prepared Chalk ℥xxv and ℥vj; Diluted Sulphuric Acid Ovij and ℥xvij; Hydrochloric Acid f℥xxviss, or as much as may be sufficient. Boil the Bitartrate of Potash with two gallons of Distilled Water, and add, gradually, half the prepared Chalk; then, the effervescence having ceased, add the remainder of the Chalk, previously dissolved in the Hydrochloric Acid, with four pints of the Distilled Water. Lastly, set aside, that the Tartrate of Lime may subside; pour off the liquor, and wash frequently the Tartrate of Lime with Distilled Water, until it be void of taste; then pour on it the diluted Sulphuric Acid, and boil for a quarter of an hour. Evaporate the strained liquor by a gentle heat, that crystals may be formed.

Dissolve the crystals, that they may be pure, again, and a third time, in water, and as often strain the liquor, boil down, and set it aside.

The following is the *theory* of the process for making tartaric acid: By the mutual action of bitartrate of potash and carbonate of lime (chalk), we obtain tartrate of potash in solution, and tartrate of lime precipitated, while carbonic acid escapes. The following diagram explains these changes:—

MATERIALS.	COMPOSITION.	PRODUCTS.
1 eq. Chalk = 50	{ 1 eq. Carbonic Acid . . . 22 1 eq. Lime 28	1 eq. Carbonic Acid = 22
1 eq. Bitartrate Potash = 180	{ 1 eq. Tartrate Potash . . 114 1 eq. Tartaric Acid . . . 66	1 eq. Tartrate Potash = 114 1 eq. Tartrate Lime = 94
230	230	230

or, $\text{KO}, 2\overline{\text{T}} + \text{CaO}, \text{CO}^2 = \text{CaO}, \overline{\text{T}} + \text{KO}, \overline{\text{T}} + \text{CO}^2$. If to the solution of tartrate of potash we add chloride of calcium (obtained by dissolving chalk in hydrochloric acid), double decomposition ensues; tartrate of lime is precipitated, and chloride of potassium remains in solution.

MATERIALS.	COMPOSITION.	PRODUCTS.
1 eq. Chlor. Calcium = 56	{ 1 eq. Chlorine 36 1 eq. Calcium 20	1 eq. Chloride Potassium = 76
1 eq. Tartrate Potash = 114	{ 1 eq. Potash { 1 eq. Potassium 40 1 eq. Oxygen . 8 1 eq. Tartaric Acid 66	1 eq. Lime 28 1 eq. Tartrate Lime = 94
170	170	170

or, $\text{KO}, \overline{\text{T}} + \text{CaCl} = \text{CaO}, \overline{\text{T}} + \text{K}, \text{Cl}$. The tartrate of lime obtained in the above two operations is then decomposed by sulphuric acid, which forms the almost insoluble sulphate of lime, and sets tartaric acid free.

MATERIALS.	COMPOSITION.	PRODUCTS.
1 eq. Tartrate Lime = 94	{ 1 eq. Tartaric Acid = 66 1 eq. Lime 28	1 eq. Tartaric Acid . . . = 66
1 eq. Sulphuric Acid = 40		1 eq. Sulphate Lime . . . = 68
134		134

or, $\text{CaO}, \overline{\text{T}} + \text{SO}^2 = \text{CaO}, \text{SO}^2 + \overline{\text{T}}$.

PROPERTIES.—Tartaric acid crystallizes in elongated, colourless, inodorous, very sour, imperfectly transparent prisms, which belong to the oblique prismatic system.² The crystals are permanent in the air. When heated, they fuse, and undergo

¹ The Edinburgh College employs the same quantity (Ovij and f℥xvij) of Diluted Sulphuric Acid formerly recommended by the London College; but, as its strength is weaker, the quantity ought to have been greater. The Edinburgh College should have directed more than ten pints of Sulphuric Acid, instead of less than eight² (Mr. R. Phillips. *Lond. Med. Gaz.* new series, vol. ii. 1838—9, p. 679).

² Brooke, *Annals of Philosophy*, new series, vol. vi. p. 118.

chemical changes varying with the degree and continuance of the heat. When they have lost by heat a fourth of their water, they become *tartralic acid*, which has, in its salts, the same composition as tartaric acid, but neutralizes one-fourth less base. It differs from tartaric acid, therefore, as pyrophosphoric acid differs

Fig. 400.

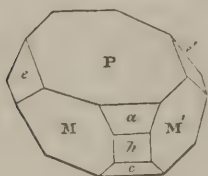
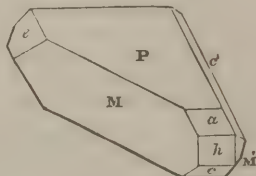


Fig. 401.



Crystals of Tartaric Acid.

Fig. 400. The crystal as usually modified. [The corresponding planes in both figures are marked with the same letters.]

Fig. 401. The same modified form, with the planes irregularly disposed, as they appear in most of the crystals.

from phosphoric acid. When tartralic acid is farther heated, it loses as much more water, and becomes *tartrellic acid*, which also has, in its salts, the composition of tartaric acid, but only half the neutralizing power. It corresponds, therefore, to metaphosphoric acid. By a higher degree of heat all the water of this acid is driven off, and we have *anhydrous tartaric acid*, which, however, has lost its acid properties, and is quite insoluble in water.¹ "This is a powerful argument in favour of the view, according to which all acids are compounds of hydrogen" (Liebig). When subjected to a distillation, tartaric acid yields carbonic acid, water, and two pyrogenous acids, one of which is crystalline, and is called *pyrotartaric acid* ($C^5H^3O^3 + Aq.$); the other is oily, and is termed *pyruvic acid* ($C^6H^3O^5 + Aq.$). Strongly heated in the air, it evolves the odour of caramel, and furnishes a carbonaceous mass, which eventually disappears by combustion. Cold water dissolves crystallized tartaric acid; boiling water takes twice its own weight of the acid. A soft mucilaginous, flexible mass is formed in a solution of tartaric acid, as well as of emetic tartar, when long kept.² Alcohol sparingly dissolves the acid. Heated with either nitric acid or potash, it yields oxalic acid. By the action of sulphuric acid on it acetic acid is formed. When heated with sulphuric acid, it is strongly blackened.

CHARACTERISTICS.—A solution of tartaric acid is very sour, and causes with solutions of caustic lime, baryta, and strontia, white precipitates (*earthy tartrates*), soluble in excess of acid. Sal ammoniac dissolves the precipitate (*tartrate of lime*) produced by lime-water. With acetate of lead, the solution of tartaric acid also forms a white precipitate (*tartrate of lead*), soluble in excess of acid. Dropped into a solution of sulphate of lime, it furnishes no precipitate. Heated with a solution of chloride of platinum, tartrate of potash occasions a black precipitate (*metallic platinum*). If excess of acid be added to a concentrated solution of a potash-salt, small granular crystals (*bitartrate of potash*) are deposited. With nitrate of silver, tartrate of potash furnishes a white precipitate (*tartrate of silver*), which, when heated, does not deflagrate, but becomes brown, froths up, evolves white fumes, and leaves pure silver.

The *London College* gives the following directions for ascertaining the purity of tartaric acid:—

Free of colour; destroyed by a red heat; soluble in water. The solution precipitates bitartrate of potassa from any neutral salt of potassa. Nothing is precipitated from the same solu-

¹ See Fremy, *Ann. de Chim. et. de Phys.* Août, 1838.

² This formation is probably owing to the development in the solution of a vegetable organized being. Keitzing (*Repertoire de Chimie*, iii. 278, Paris, 1838) has described and figured the plant which forms in a solution of emetic tartar.

tion by chloride of barium. That which acetate of lead precipitates is soluble in nitric acid. One hundred grains of this acid dissolved in water are saturated by 192 grains of crystals of carbonate of soda.

COMPOSITION.—The composition of tartaric acid is as follows:—

	Atoms.	Eq.Wt.	Per Cent.	Berzelius.		Atoms.	Eq.Wt.	Per Ct.
Carbon	4	24	36.36	35.980	Anhydrous Tar-	} 1	66	88
Hydrogen	2	2	3.03	3.807	tartic acid . . .			
Oxygen	5	40	60.61	60.213	Water	1	9	12
Anhydrous Tartaric } Acid }	1	66	100.00	100.000	Crystallized Tar- } tartic Acid . . . }	1	75	100

or, $C^4H^2O^5$ —Symbol \overline{T} ; or, $C^4H^2O^5 + HO$.

Liebig regards the equivalent weight of the acid as double that above assumed; and the acid, therefore, is considered as a bibasic one, inasmuch as, on that hypothesis, it saturates two equivalents of base. [According to Liebig, therefore, the formula of the crystallized acid is $C^8H^4O^{10} + 2HO$, and of the acid in the bibasic salts, $C^8H^4O^{10} = \overline{T}$.—ED.] Fremy's researches, above referred to, tend to support this view.

IMPURITY.—The only adulteration practised on this acid is the mixture of its powder with bitartrate of potash. This fraud may be detected by the difficult solubility in water of the bitartrate, and its yielding, on incineration, carbonate of potash (known by the tests hereafter to be described). The tests of the purity of the acid, given by the Edinburgh College, are as follows:—

"When incinerated with the aid of the red oxide of mercury, it leaves no residuum, or a mere trace only."—Ph. Ed.

This test is devised to detect any fixed substance, and might be used to recognize the potash, if bitartrate of this alkali had been present.

PHYSIOLOGICAL EFFECTS.—The effects of tartaric acid, in small doses properly diluted, are those of a refrigerant. It reduces febrile heat, diminishes excessive vascular action, allays thirst, checks excessive perspiration, and perhaps also a too copious secretion of bile. It appears to promote the action of the absorbents, to increase the secretion of urine, and to act gently on the bowels. It possesses the tonic properties of the mineral acids in a very slight degree only, if at all. Its continued use very readily disturbs the digestive process. Some doubt exists as to the effect of large doses of the acid. According to Dr. Christison,¹ it may be taken in very considerable quantities without injury. Six drachms have been taken in twenty-four hours without inconvenience. Pommer, however, asserts that, when it is injected into the veins, it is scarcely less poisonous than oxalic acid. (*Ibid.*) [One ounce of the acid taken at a dose, dissolved in half a pint of warm water, produced violent inflammation of the alimentary canal, and death in nine days.—ED.]

USES.—Tartaric acid may be used as a cheap substitute for citric acid or lemon-juice, in the formation of acidulous refrigerant drinks, for febrile and inflammatory disorders. It is, however, rarely employed for this purpose. Its common medicinal use is in the preparation of effervescing compounds, with the alkaline carbonates, especially with bicarbonate of soda.

EFFERVESCING TARTRATES.—The following are the relative proportions of tartaric acid and alkaline carbonates for preparing effervescing draughts:—

20 grains of the Crystals of Tartaric Acid are saturated by—

Crystallized Bicarbonate of Potash	27 grs.
Carbonate of Potash of Commerce	22 "
Hydrated Sesquicarbonate of Ammonia	15½ "
Crystallized Carbonate of Soda	38½ "
Sesquicarbonate of Soda of Commerce	22 "

The most commonly used effervescing tartrate is that made with sesquicarbonate of soda (see *Sodæ Sesquicarbonas* and *Sodæ Tartras*).

¹ *Treatise on Poisons*, 3d edit. p. 208.

310. ACIDUM OXALICUM.¹—OXALIC ACID.

HISTORY.—This acid was discovered by Scheele, though the credit of its discovery was for a long time given to Bergmann.²

NATURAL HISTORY.—It is found in both kingdoms of nature. In the *Inorganic Kingdom*, oxalic acid, in combination with the protoxide of iron, constitutes the mineral denominated by Rivero, *Humboldtine*; by Necker and Beudant, *Humboldtite*. In the *Organized Kingdom*, oxalic acid is found in both plants and animals, but principally in the former. Oxalic acid, in combination with either lime or potash, is a constituent of a considerable number of plants, especially those belonging to the orders *Polygonaceæ* and *Lichenaceæ*. Oxalate of lime is found in Rhubarb, Bistort, many Lichens, &c. Some Lichens contain nearly half their weight of oxalate of lime. In *Variolaria faginea* (*V. communis*), Braconnot found 47.4 per cent. of this salt. Combined with potash, oxalic acid is found in *Oxalis Acetosella*, *Rumex Acetosa*, Rhubarb, &c. Oxalate of soda is found in *Sal-sola*. A solution of free oxalic acid is said to exude from the hairs of *Vicer Arietinum*, but the accuracy of the statement is doubtful. Oxalate of lime constitutes the Mulberry Calculus, and is found in the Liquor Allantoidis of the cow.

PREPARATION.—Oxalic acid is obtained by the action of nitric acid on sugar or potato starch. Treacle is usually employed in this country as a substitute for solid sugar. The process is generally conducted in open earthenware jars, heated by a warm water bath. The nitrous vapours evolved are usually allowed to escape into the air. In France, attempts have been made to economize them by their employment in the manufacture of sulphuric acid (see *Sulphuric Acid*). To prevent their noxious influence on the workmen and the surrounding neighbourhood, as well as to economize them, a patent has been taken out to conduct the process in closed vessels connected with receivers and condensers, by which the vapours are condensed and collected again to be used.³ Oxalic acid is also obtained by digesting, by aid of a gentle heat, one part of sugar, or, better still, of potato starch, in 5 parts of nitric acid of sp. gr. 1.42, diluted with 10 parts of water, as long as gaseous products are evolved; by evaporation, the acid is obtained in crystals, which may be purified by a second crystallization, after being well dried on paper or porous earthenware. From 12 parts of potato starch, 5 of the acid are obtained. The mother liquor should be treated with an additional quantity of acid, and again warmed, when a second crop of crystals will be obtained; this is repeated until the solution is quite exhausted.⁴

The formation of oxalic acid depends on the oxidation of organic matter, at the expense of part of the oxygen of the nitric acid, while nitrous vapours are given out. Those organic matters, as sugar and starch, which contain oxygen and hydrogen in the same proportion as water, yield it in the greatest quantity. One equivalent of anhydrous sugar ($C^{12}H^{10}O^9$), and eighteen equivalents of oxygen (O^{18}), contain the elements of six equivalents of anhydrous oxalic acid ($6C^2O^3$), and nine equivalents of water ($9HO$). But the process is not so simple as this calculation would lead us to suppose. Part of the carbon of the sugar escapes in the form of carbonic acid gas. The mother liquor contains, besides some acetic acid, saccharic acid ($C^{12}H^8O^{11}$); which, when acted on by a farther portion of nitric, is converted into oxalic and carbonic acids. If the nitrous vapours be conveyed into a condenser, nitric and nitrous acids may be collected.

PROPERTIES.—The crystals of oxalic acid are colourless, transparent prisms,

¹ This acid has been omitted, inadvertently I presume, in the Edinburgh Pharmacopœia, though it is directed to be employed in the preparation of oxalate of ammonia.

² See Thomson's *System of Chemistry*, vol. ii. p. 15, 7th ed. Lond. 1831.

³ *Repertory of Patent Inventions*, N. S. vol. vii. p. 5, Lond. 1837 — A patent has been taken out for preparing this acid in leaden vessels, and for obtaining it from potatoes (*Ibid.* N. S. vol. xv. p. 363, Lond. 1841).

⁴ Liebig, in Turner's *Elements of Chemistry*, p. 698, 7th ed. Lond. 1840.

which belong to the oblique prismatic system. They are usually flattened, six-sided (by the truncation of one pair of the lateral edges), and have two or four terminal planes.¹ The crystals of oxalic acid taste and react on vegetable colours powerfully acid. When pure, they have no odour. Exposed to a warm air they effloresce, evolve 28 per cent. (equal to two equivalents) of water, and become a pulverulent residue (*hydrate of oxalic acid*). When heated rapidly to 350° F. they fuse, evolve water, and the hydrate of the acid sublimes, a portion of it at the same time undergoing decomposition, but no residue being left if the acid be quite pure. They dissolve in from 8 to 11 parts of water at 60° F., in their own weight of boiling water, and in 4 parts of alcohol at 60° F. By the action of oil of vitriol, aided by heat, they are resolved into water, which remains with the sulphuric acid, and equal volumes of carbonic acid and carbonic oxide gases.

CHARACTERISTICS.—Oxalic acid strongly reddens litmus, and is entirely volatilized by heat. By the effect of heat, it is at once known from the sulphates of magnesia and zinc, both of which are fixed. Nitrate of silver added to a solution of it, yields a white precipitate (*oxalate of silver*), which is soluble in nitric acid, and when dried and heated on the point of a knife, by the flame of a candle or spirit-lamp, becomes brown on the edge, very feebly detonates, and is completely dissipated, being converted into water, carbonic acid, and metallic silver. With lime-water, or a solution of chloride of calcium, oxalic acid yields a white precipitate (*oxalate of lime*), insoluble, or nearly so, in excess of oxalic acid, readily soluble in nitric acid, and slightly so in hydrochloric acid. If the precipitate be collected, dried, and calcined, it yields quicklime. With sulphate of copper, oxalic acid yields a bluish-white precipitate (*oxalate of copper*). It reduces the sesquichloride of gold, and deoxidizes iodic acid on boiling.

To detect oxalic acid in oxalate of lime, proceed as follows: Boil the oxalate with a solution of carbonate of potash for two hours, and filter. The liquor contains oxalate and carbonate of potash. Add acetate of lead, collect the precipitate (*oxalate and carbonate of lead*), suspend it in water, through which sulphuretted hydrogen is to be passed; filter (to get rid of the dark sulphuret of lead), boil the clear liquor, which is a solution of oxalic acid, and test as above for the free acid. If the oxalate of lime were mixed with organic matter, the filtered liquor should be feebly acidulated with nitric acid, before adding the acetate of lead. The acidulated liquor should be filtered, rendered faintly alkaline by carbonate of potash, again filtered, and then mixed with acetate of lead, and the precipitate treated as above.

COMPOSITION.—Anhydrous oxalic acid, as it exists in dry oxalate of lead, has the following composition:—

	Atoms.	Eq. Wt.	Per Cent.	Or,	Atoms.	Eq. Wt.	Per Cent.
Carbon	2	12	33.3	Carbonic Acid . . .	1	22	61.1
Oxygen	3	24	66.6	Carbonic Oxide . . .	1	14	39.9
Anhydrous Oxalic Acid . .	1	36	100.0		1	36	100.0

Crystallized oxalic acid contains three equivalents of water, of two of which it may be deprived by heat, leaving what has been termed *hydrate of oxalic acid*. The composition of these two substances is as follows:—

	Atoms.	Eq. Wt.	Per Cent.		Atoms.	Eq. Wt.	Per Cent.
Anhydrous Oxalic Acid	1	36	57.14	Anhydrous Oxalic Acid	1	36	50
Water	3	27	42.86	Water	1	9	20
Crystallized Oxalic Acid	1	63	100.00	Hydrate of Oxalic Acid	1	45	100

Some chemists regard the hydrate of oxalic acid as a real hydracid, composed of $C^2O^4 + H$. [The formula of this acid, in the anhydrous state, is $2CO + O$, or C^2O^3 ; Symb. $\bar{O} = \text{eq. } 36.24$. The formula of the hydrated acid, 1 at. $\bar{O} + 1 \text{ eq. } HO \text{ eq.} = 45.24$; and of the crystallized acid, 1 at. $\bar{O} + 3 \text{ eq. } HO \text{ eq.} = 63.24$.—ED.]

IMPURITY.—The crystals of oxalic acid of commerce are sometimes contaminated

¹ Crystallized oxalic acid has often been mistaken for sulphate of magnesia, and the consequence has been fatal in many instances. Sulphate of zinc and bichloride of mercury are likewise apt to be confounded with this acid.

with nitric acid. In this state they have usually a faint odour, and stain the cork of the bottle, in which they are kept, yellow. If they be exposed to a warm atmosphere, the nitric acid escapes along with the water of crystallization. [The presence of nitric acid may be detected by boiling the crystals with a weak solution of sulphate of indigo. The colour is discharged.—Ed.]

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—A solution of oxalic acid acts as a poison to plants.¹ The acid (solid?) has been said to promote the germination of old seeds;² but I suspect the statement to be inaccurate.

β. On Animals.—The best series of experiments on the effects of this acid on animals are those of Christison and Coindet.³ They found that concentrated solutions of half-ounce doses of this acid introduced into the stomachs of cats and dogs caused exquisite pain, violent attempts to vomit, dulness, languor, great debility, and death in from two to twenty minutes. A *post-mortem* examination of the bodies showed softening and corrosion of the inner coat of the stomach. Large doses of a dilute solution caused great depression of the heart's action; and small doses gave rise to tetanus or narcotism. Farthermore, the acid acts with great violence, and produces nearly the same effects, to whatever part of the body it is applied. From these results it has been inferred that the concentrated acid is a corrosive poison—while the dilute acid ceases to be corrosive, but, becoming absorbed, acts on the brain, spinal cord, and heart. It appears to me absurd to suppose, as is usually done, that a dilute solution ceases to act chemically. It does not, indeed, destroy the gastric membrane as a concentrated solution does, but doubtless it must effect some chemical change on the blood when it gains access to it; though the precise alteration may hitherto have evaded notice. We know that a twentieth part of oxalic acid added to boiling syrup renders it thin, and incapable of crystallizing; and it is possible that its action on other organic substances may be equally energetic; and thus alterations may be effected in the condition of the blood, which, though not very marked, may nevertheless be sufficient to render this fluid incapable of supporting life.

γ. On Man.—The effects of oxalic acid on the human subject vary somewhat with the dose. When this is large, and the solution concentrated, acute pain is experienced; but, after small doses and dilute solutions, this symptom is not well marked. Vomiting is usually present. The circulation is always depressed; the pulse being feeble or failing, and the surface cold and clammy. Nervous symptoms (such as lassitude, weakness of the limbs, numbness, pain in the back extending down the thighs, and, toward's the end, convulsions) have sometimes, but by no means invariably, made their appearance. But death follows so speedily after the injection of large doses (“few of those who have died survived above an hour,” *Christison*), that the symptoms have not been fully made out. If life be prolonged for a few hours, symptoms of gastro-enteritis are observed. *Post-mortem* examination discovers irritation and often corrosion of the stomach. Some years since, I opened the body of a man who died in twenty minutes after swallowing oxalic acid by mistake for Epsom salts. The *post-mortem* examination was made a few hours after death, and while the body was quite warm. The stomach presented a diffused redness, like that of a part affected with erysipelas. The epithelium was destroyed, and presented, in patches, the appearance of the scalded cuticle, or of the pellicle which forms on the surface of boiling saline solutions.

USES.—Oxalic acid is not at the present time used in medicine. In France, *Tablettes d'Acide Oxalique* are prepared. Either free or combined with ammonia, it is a valuable test for lime. It is employed for removing ink stains and iron moulds from linen; for cleaning the leather of boot-tops; and for certain styles of discharge in calico-printing.

¹ Marceet, quoted by De Candolle, in his *Physiologie Végétale*, t. iii. p. 1355, Paris, 1832.

² *Repertory of Patent Inventions*, vol. xiii. p. 408. 1832.

³ *Edinburgh Medical and Surgical Journal*, vol. xix.—In Wibmer's work (*Die Wirkung*, &c. Bd. iv. S. 35) will be found a notice of the experiments of Rave and Kiosterinnann.

ANTIDOTES.—In cases of poisoning by this acid, it is advisable to administer as speedily as possible large quantities of chalk, whiting, or magnesia, suspended in water, by which inert earthy oxalates are formed in the stomach. In the absence of these antidotes, large quantities of warm water may be administered, and at the same time vomiting is to be promoted by tickling the throat. Small quantities of water may prove injurious by favouring absorption. Alkalies do not deprive the acid of its poisonous operation. The stomach-pump and emetics may be used; but, on account of the rapidity with which this acid acts, it is not advisable to lose time by their application until after the antidote has been administered. The same treatment is to be adopted in poisoning, by the following salts:—

1. AMMONIÆ OXALAS, E.—See vol. I.

2. POTASSÆ OXALATES.—See vol. I.

311. CREASOTON, L.—CREASOTE.

Creazotum, E.—Creasotum, D. [U. S.].

(An Oxy-hydro-carburet; prepared from pyroxylic oil, L.)

HISTORY.—This substance was discovered a few years since by Reichenbach, who termed it *Creasote* (from *κρέας*, *flesh*, and *σώζω*, *I preserve*), or the *flesh-preserver*, on account of its antiseptic property. Its name is sometimes written *Creosote*, or *Kreosote*.

NATURAL HISTORY.—It is an artificial product; and is obtained by the destructive distillation of organic substances. It is found in pyroligneous acid, in tar, in Dippel's oil, in wood smoke, and empyreumatic waters.

PREPARATION.—The preparation of creasote is a very troublesome and tedious process. The following concise abstract of it is taken from Turner's *Elements of Chemistry* (5th edit. p. 872). Those portions of the oil (called in the Pharmacopœia *pyroxylic oil*) distilled from wood-tar, which are heavier than water, are first freed from adhering acetic acid by carbonate of potash, and, after separation from the acetate, are distilled. A little phosphoric acid is mixed with the product to neutralize ammonia, and another distillation resorted to. It is next mixed with a strong solution of potash, which combines with creasote, allows any eupion which may be present to collect on its surface, and by digestion decomposes other organic matter: the alkaline solution is then neutralized by sulphuric acid, and the oil which separates is collected and distilled. For the complete purification of the *creasote*, this treatment with potash, followed by neutralization and distillation, requires to be frequently repeated.¹ The oil from which creasote is prepared is that obtained by the distillation of wood-tar, and is either imported from Stockholm, Archangel, and America, or is made in the manufacture of pyroligneous acid.

PROPERTIES.—Pure creasote is colourless and transparent; and has a high refractive power, and an oleaginous consistence. Its odour is that of smoked meat, its taste burning and caustic, its sp. gr. 1.037 at 68° F. [According to the Dublin Pharmacopœia, its sp. gr. is 1.066.—Ed.] It boils at 397° F.; and is fluid at —16.6° F. It is combustible, burning with a sooty flame. It absorbs chlorine, and is resinified by it. Nitric acid is decomposed by it, with the evolution of nitrous fumes. Sulphuric acid in small quantity reddens, and in large quantity blackens it. Potassium decomposes it, with the evolution of gas (hydrogen?) and the formation of potash, which combines with some inspissated creasote. It is soluble in alcohol, ether, sulphuret of carbon, eupion, naphtha, acetic acid, and acetic ether. It dissolves resins, various colouring matters (as of cochineal, saffron, and madder), and some salts (as the acetate of potash). It has very little action on caoutchouc, and does not possess any acid or alkaline reaction on test paper. Mixed with water,

¹ For farther details I must refer to Dumas's *Traité de Chimie*; the *Ann. de Chim. et Physiq.* t. 57, 1834; and Cozzi, in the *Journal de Pharmacie*, t. xxviii. p. 629.

it forms two combinations: one is a solution of 1.25 parts of creasote in 100 of water; the other, on the contrary, is a solution of 10 parts of water in 100 of creasote.

It coagulates soluble albumen. Concentrated albuminous liquids are immediately coagulated by it; diluted ones, gradually. Fibrin is not altered by it. It is powerfully antiseptic with respect to meat and fish. Tar, smoke, and crude pyroligneous acid, owe part, if not the whole, of their antiseptic properties to it. According to Dr. J. R. Cormack,¹ the only essential part of the mummifying process practised by the ancient Egyptians was the application of such a heat as would first dry up the body, and then decompose the tarry matters which had been previously introduced, and thus generate creasote.

CHARACTERISTICS.—The odour of creasote is its most characteristic property. To this must be added its combustibility, its oleaginous appearance, its complete solubility in acetic acid and caustic potash, and its action on albumen before mentioned.

IMPURITY.—Creasote, when pure, is perfectly colourless; but that met with in commerce has frequently a more or less brownish tinge. Rectified oil of tar, capnomor, and a substance like almond oil, have been mixed with it.² These impurities are readily detected by mixing separate portions of the suspected liquid with acetic acid and caustic potash: pure creasote is completely soluble in these fluids; not so the adulterated. Capnomor is similar to creasote in many of its physical and chemical properties, and is frequently associated with the creasote of the shops.

COMPOSITION.—Ettling³ analyzed creasote which was supposed to contain three per cent. of water. Making allowance for this impurity, its composition, as determined by this chemist, is nearly as follows:—

	Atoms.	Eq. Wt.	Per Cent.
Carbon	14	84	77.42
Hydrogen . . .	9	9	8.12
Oxygen	2	16	14.46
Creasote . . .	1	109	100.00

or, $C_{14}H_9O_2$. At present, however, the equivalent of creasote must be considered as uncertain, since no definite compound of this substance has been analyzed, by which the combining proportion could be ascertained.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Plants moistened with creasote water fade and die.⁴ The injurious effects of smoke on vegetation are probably to be referred principally to the creasote which it contains.

β. On Animals generally.—Insects (as flies), spiders, and small fishes, die in two minutes after their immersion in water containing a few drops of creasote suspended in it. According to Dr. Cormack, the effects of creasote on dogs are remarkably similar to those of hydrocyanic acid, and are much less apparent when this substance is injected into the carotid arteries than into the veins. When thrown into the latter, it suddenly stops the heart's action, and causes hurried respiration, one or two convulsive fits, shrill cries, and death. Injected into the carotid artery, it produces coma. Introduced into the stomach, it gives rise to dimness and fixation of the eyes, vertigo, and coma; when given in large quantities, it also affects the heart.⁵ Corneliani⁶ and Miguët have observed inflammation of the gastro-intestinal mucous membrane of dogs poisoned by creasote, but which survived some time after its administration.

γ. On Man.—Creasote operates locally as an irritant and caustic. Applied to the skin it causes heat, redness, and the destruction of the cuticle, which comes away in the form of furfuraceous scales. On the tongue it produces a painful sensation. Dropped into the eye, it occasions acute pain. Placed in contact with a suppurating

¹ *Treatise on Creasote.* Edinburgh, 1836.

² *Ann. de Chimie.* liii. p. 333.

³ Miguët, *Recherches sur la Créasote.* 1834.

⁴ *Jour. Chem. Méd.* t. ii. ser. 10; and *Brit. and For. Med. Rev.* vol. i. p. 265.

⁵ Cormack, *op. cit.*

⁶ Cormack, *op. cit.* p. 66, et seq.

surface, it whitens the part, like nitrate of silver. Swallowed in large doses, it causes vomiting and purging. The caustic effect of creasote depends on its union with albumen. Unless largely diluted, it occasions, when swallowed, heat in the pharynx, œsophagus, and stomach. Small doses, as one or two minims, produce in most individuals no other unpleasant effect than that just mentioned. Larger doses give rise to nausea, vomiting, vertigo, headache, and heat of head. Dr. Elliotson¹ knew a lady who increased the dose of creasote to forty drops before it disagreed; the addition of a single drop beyond this produced extreme giddiness, insensibility, and vomiting, followed by headache for several days. When given in moderate doses, it does not affect the bowels; so that, as Dr. Elliotson has observed, “aperients are as requisite as if it was not taken.” When, however, the dose has been considerably augmented, diarrhœa, or even dysentery, has been produced.² The influence of creasote on the urinary organs is sometimes very marked. Dr. Macleod³ was, I believe, the first who noticed that the urine acquired a blackish colour by the use of it. A similar effect is referred to by Dr. Elliotson. In some cases creasote is recognized, by its odour, in the urine, showing that it has been absorbed. Occasionally it increases the quantity of this secretion; but, in diabetes, it sometimes has an opposite effect. In some instances it has caused micturition and strangury, so that in its influence over the urinary organs it bears some resemblance to turpentine. Some other effects which have been ascribed to it require farther evidence to establish them. In the dose of two drachms, creasote proved fatal in thirty-six hours. It caused acute pain.⁴

USES.—Various substances, some known to contain creasote, others supposed to do so, have long been used in medicine, in the same diseases in which creasote itself is now employed; and, in consequence, it has been imagined that they owe part of whatever efficacy they really possess to this substance. These remarks apply to Tar,⁵ Soot,⁶ Crude Pyroligneous Acid, *Aqua Binelli*,⁷ the Empyreumatic Water of Runge and Hanke, Pyrothonide,⁸ and Animal or Dippel’s Oil. To this list should be added, according to Dr. Cormack (*op. cit.*), Mummy.

As an *internal* remedy, creasote has been principally celebrated, in this country, as a medicine possessing extraordinary powers of arresting vomiting. It has, however, been greatly overrated. It is decidedly injurious in inflammatory conditions and structural disease of the stomach, and frequently fails in allaying the sickness dependent on organic diseases, as of the heart and kidneys. It is most successful

¹ *Medico-Chirur. Trans.* vol. xix.

² *Lond. Med. Gaz.* vol. xvi. p. 599; and vol. xvii. p. 653.

³ See *The Times* of June 17, 1839. I presume the mental faculties were unaffected.

⁴ Tar will be described hereafter.

² Cormack, *op. cit.* p. 93.

⁶ WOOD SOOT (*Fuligo Ligni*) was formerly contained in the list of the *Materia Medica* of the British Pharmacopœias. It is still in use on the continent, and statements of its efficacy are occasionally met with in the periodicals. It is a mixture of distilled products from the imperfectly burnt wood and of ashes, or other fixed matters, carried up the chimney by the current of air. It consists of a pyrogenous or empyreumatic resin called *pyretin*, combined with *acetic acid*, which also saturates the bases (*potash, lime, and magnesia*) of the ashes which are carried up the chimney. Besides these, there are small quantities of *s sesquioxide of iron, silica, and carbon. Acetate of ammonia, chloride of calcium, and sulphate of lime*, are also contained in soot. Moreover there is *extractive matter*, part of which is insoluble in alcohol. Lastly, to these constituents must be added *creasote*. Braconnot (*Ann. Chim. et. Phys.* t. xxxi. p. 37) mentions a bitter principle, which he calls *asboline* (from ἀσβλην, soot), in soot; but Berzelius (*Traité de Chimie*, t. vi. p. 725) considers it to be a mixture of different matters with the acid pyretine. The matters insoluble in water constitute about 0.44 of soot. Formerly soot was esteemed tonic, antispasmodic, and emmenagogue. It is now principally employed as an external remedy, chiefly in ringworm and other analogous eruptions, and obstinate ulcers. It is employed in the form of *decoction* (prepared by boiling two handfuls of soot in a pint of water for half an hour) and of *ointment* (composed of a drachm of soot to an ounce of lard). The decoction has been used as an injection in chronic cystitis (*Lond. Med. Gaz.* 1839—40, vol. i. p. 864). The *Tincture of Soot*, formerly in the London Pharmacopœia, consists of Wood Soot 3j; Assa-fœtida 3; and Proof Spirit f3xxxij. It is sometimes called *Soot Drops* or *Hysteric Mixture*, and is prescribed in doses of one or two teaspoonfuls in hysteria.

⁷ AQUA BINELLI, or *Aqua arterialis balsamica Doctoris Binelli*, a once-celebrated styptic, discovered by a physician (Dr. Binelli) of Turin, in 1797, (*Dierbach, Neuesten Entdeck. in d. Mat. Med.* 2te Ausg. 1837. See also Dr. J. Davy, *Edinb. Med. and Surg. Journ.* July, 1833.)

⁸ PYROTHONIDE (from πυρ, fire; and θων, linen), or *liquor pyro-oleosus e linteo paratus*, is a very popular remedy for toothache and skin diseases. It is sometimes prepared by distilling rags, and is then called *rags oil*; but the common mode of procuring it is to burn a cone of paper on a plate or other cold body; it is then termed *paper oil*. It has been analyzed by Herberger (Buchner, *Repertorium*, Bd. 32. S. 317). For farther particulars concerning it, consult Mérat and De Lens, *Dict. Mat. Méd.*; Lieberbach, *op. cit.*; Schwartz, *Pharm. Tabell.* 2te Ausg.; L. Richter *Ausführl. Arzneim.* Supplem. Bd.

in hysterical cases, and sometimes succeeds in pregnancy. Creasote was first employed to relieve vomiting by Dr. Elliotson,¹ to whose paper, as well as to that of Mr. Taylor, apothecary of the North London Hospital,² I must refer for cases illustrative of extraordinary success with it. It is regarded by Dr. Macleod³ as of doubtful efficacy; and has completely failed in the hands of Dr. Paris.⁴ Dr. Burne,⁵ however, found it efficacious in gastro-enteritic irritation. I have found it much more frequently fail than succeed in alleviating irritable stomach. It sometimes relieves the chronic vomiting connected with granular disease of the kidneys when other means fail.⁶ In *gastrodynia* or *flatulence* it occasionally succeeds, but is admissible in those cases only in which local stimulants are usually found beneficial. Where both hydrocyanic acid and creasote have been separately tried without success, Dr. Elliotson advises their union. Creasote has been tried in a few cases of *diabetes*. In some it diminished both the quantity and saccharine quality of the urine.⁷ I have tried it at the London Hospital, but without obtaining benefit from its use. In neuralgia, hysteria, and pulmonary diseases, it has also been used with occasional advantage; but a more extended experience is required to establish its efficacy in these cases.

As an *external* agent, creasote may frequently be employed with great advantage. It has been successfully applied to relieve *toothache*. After carefully cleaning out the cavity of the tooth, a drop of creasote, or an *alcoholic solution* of this principle, may be introduced by means of a camel's hair pencil, and the cavity filled with cotton soaked in this liquid. As a local application to chronic skin diseases (particularly the different forms of porrigi, impetigo, eczema) it is of considerable value. Where a caustic application is required, it may be applied undiluted; but for other purposes, it is used either in the form of ointment, or dissolved in water as a wash. Creasote may be beneficially used as an application to foul and indolent ulcers. It serves the double purpose of stimulating the living surface (and thereby of changing the quality of actions going on in the part), and also of preventing the putrefaction of the secreted matters. It is sometimes applied pure, but more commonly diluted with water. Lupus is said to have healed under the employment of an ointment of creasote.⁸ In hemorrhages creasote acts as a most efficient styptic, partly in consequence of its power of coagulating albuminous liquids, and thereby of causing the formation of a clot, and partly by causing contraction of the bleeding vessels. *Creasote water* (prepared by mixing one part of creasote with eighty parts of water) may be applied either to bleeding wounds and leech-bites, or introduced into the vagina in uterine hemorrhage, by means of pledgets of lint soaked in it. There are many other purposes for which creasote has been applied as a local agent, but which I think it sufficient merely to name, referring the reader to the various papers and works before quoted for farther information. It has been employed to check caries, to restrain excessive suppuration, and to repress fungous granulations in burns and scalds; to act as a counter-irritant in chronic ophthalmia, in which disease it is sometimes dropped into the eye on the same principle that nitrate of silver and other local stimulants are used; and to remove condylomatous and other excrescences. The inhalation of creasote vapour is occasionally useful in relieving excessive bronchial secretion. Dr. Elliotson cured two cases of glanders in the human subject by injecting an aqueous solution of creasote up the affected nostril.⁹

ADMINISTRATION.—Creasote may be given, at the commencement of its use, in doses of one or two drops diffused through an ounce of some aromatic water by the aid of mucilage: the dose should be gradually increased. As before mentioned, in

¹ *Medico-Chirurg. Trans.* vol. xix.

² *London Medical Gazette*, vol. xvi. p. 598, and vol. xvii. p. 653.

³ *Appendix to the 5th edit. of the Pharmacologia*, 1838.

⁴ *London Medical Gazette*, August 12, 1835.

⁵ See Christison, *On Granular Degeneration of the Kidneys*, Edinb. 1839.

⁶ Dr. Elliotson, *Med.-Chirurg. Trans.*; and Professor Berndt, *Lancet*, July 18, 1835.

⁷ Mr. Browne, in the *London Medical Gazette* for April 7, 1836.

⁸ See also *Lancet*, vol. ii. for 1834—5, p. 398.

⁹ *Lancet*, August 15, 1835.

one case forty drops were given with impunity; in another instance, ninety drops were administered in less than half a day without any bad symptom.¹

As a caustic, undiluted creasote is sometimes applied by means of a camel-hair pencil.

Lotions, gargles, or injections of creasote, are prepared by dissolving from two to six drops (according to the circumstances of each case) in an ounce of water. A solution of this kind is sometimes mixed with poultices.

The inhalation of creasote vapour may be effected by diffusing a few drops of creasote through water or a mucilaginous liquid, and breathing through this by means of the ordinary inhaling bottle.

ANTIDOTES.—In a case of poisoning by creasote, the depression of the vital powers is to be counteracted by ammonia and other stimulants. Dr. Cormack suggests the use of chlorine, but the value of this agent has not been determined by actual experiment. Oleaginous and mucilaginous drinks are recommended by Corneliani for the purpose of preventing the local action of creasote on the mucous lining of the stomach and intestines. Vinegar does not diminish, but, according to Corneliani, increases its activity. Dr. Cormack says albumen augments [?] its poisonous operation. Bleeding is suggested by this writer, in order to relieve the distension, and thereby to excite the contractions, of the heart. Artificial respiration should on no account be omitted. Any inflammatory symptoms which may subsequently appear are of course to be treated by the usual antiphlogistic measures.

1. MISTURA CREASOTI, *Mistura Creazotæ*, E.—(Take of Creazote and Acetic Acid, of each ℥xvj; Compound Spirit of Juniper, and Syrup, of each fʒj; Water fʒxiv; mix the creazote with the acid, then gradually [add] the water, and lastly the syrup and spirit.)—Dose fʒj to fʒij or more.

2. UNGUENTUM CREASOTI, L. D. [U. S.]; *Unguentum Creazoti*, E.—(Creasote fʒss; Lard ʒj; rub them together, L. [U. S.].—Axunge ʒij; Creazote ʒj. Melt the axunge, add the creazote, stir them briskly, and continue to do so as the mixture concretes on cooling, E. Take of Creazote ʒj; Ointment of White Wax ʒvij. To the ointment liquefied by a moderate heat add the creasote, and stir constantly until the mixture concretes, D.)—It is used principally in skin diseases, as ringworm. The quantity of creasote may be augmented or lessened, according to circumstances.

312. PETROLEUM, L. E.—PETROLEUM, OR ROCK OIL.

Petroleum Barbadense, L.

(*Bitumen Petroleum*. *Petroleum Barbadense*.)

HISTORY.—Herodotus² mentions the petroleum springs of Zacynthus (now called Zante) more than 400 years before Christ. Plutarch, in his *Life of Alexander*, speaks of a lake of naphtha at Ecbatana (now Hamedan), in Media. The substance known to mineralogists as petroleum is the *black naphtha* (νᾶφθα μέλαινα) of Dioscorides (lib. i.), the *bitumen liquidum* of Pliny, (lib. xxxv.)

NATURAL HISTORY.—There are two varieties of liquid bitumen or mineral oil: one is transparent and nearly colourless, or only slightly yellow, and, when burnt, leaves no residuum; the other is thick, of a reddish-brown colour or blackish, and leaves, after combustion, a black coal. The first is called *naphtha* (a Chaldean word); the second *petroleum* (from *petra*, a rock; and *oleum*, oil), or *rock oil*, because it is frequently found exuding in the form of an oily liquid from rocks. Both kinds are supposed to be produced by the decomposition of organic (vegetable) matter, for they are always found in Neptunian rocks, and they appear sometimes to be one of the products of the decomposition of coal.³ From the investigation of

¹ Mr. Taylor, *Lancet*, August 15, 1835.

² Berzelius, *Traité de Chim.* t. 6me.

³ *Melpomene*, cxcv.

Drs. Christison and Gregory,¹ it appears probable that some varieties of petroleum, as that of Rangoon, are products of destructive distillation, since they contain paraffine and eupion, substances obtained from organic bodies by heat.

Petroleum is found in this country at Ormskirk, in Lancashire, at Colebrook Dale, and at St. Catherine's Well, near Edinburgh. In France, it is produced at the village of Gabian, in Languedoc, and hence it was termed *Oleum Gabianum*. It is also found in various parts of Europe, especially in Italy. In the United States of America it is met with in various places; that from the shore of Seneca Lake, in New York, is called *Seneca Oil*. Several of the West India Islands, especially Barbadoes and Trinidad, yield it. The Barbadoes petroleum (*Petroleum Barbadosense*, L.; *Pisselæum Indicum*, Dale) is commonly termed *Barbadoes Tar*, or *Barbadoes Naphtha*. Mr. Hughes² speaks of two kinds of it; one of a dirty black, inclining to green, issuing from some hills in St. Andrew's and St. Joseph's parishes; and one of a blacker colour, in St. Joseph's parish. That imported by Mr. Clarke professes to be the produce of the springs on Mount Hall estate, in Barbadoes. In various localities of Asia, petroleum is met with in great abundance.

EXTRACTION.—Mr. Hughes says that the mode of procuring the green tar of Barbadoes, is to dig a hole or trench in, or very near, the place where it oozes out of the earth. This by degrees becomes filled with water, having a thick film or cream of this liquid bitumen swimming upon the surface; from whence it is skimmed off, and preserved in earthen jars or other vessels. The most convenient season for gathering it is in the months of January, February, and March.

PROPERTIES.—Barbadoes petroleum, at ordinary temperatures, has the consistence of treacle; its colour is reddish-brown or blackish; its odour and taste are bituminous. It floats on water; is combustible, yielding a thick black smoke, and leaving a carbonaceous residuum. It is insoluble in water and alcohol.

COMPOSITION.—The ultimate constituents of Barbadoes petroleum are carbon and hydrogen, with small quantities of oxygen and nitrogen. The latter probably are accidental.

By distillation, five parts by measure yield rather more than four parts of a yellow oily fluid, somewhat similar in appearance to the liquid carbo-hydrogen obtained in the manufacture of oil-gas, but dissimilar to naphtha. The residuum in the retort is a substance analogous to asphaltum. It yields by destructive distillation traces of ammonia. Some kinds of petroleum contain paraffine and eupion.

PHYSIOLOGICAL EFFECTS.—Petroleum possesses stimulating properties, which are principally observed in its effects on the organs of secretion (the skin, the kidneys, and the mucous membranes), the activity of which it promotes: hence it has been called sudorific, diuretic, and expectorant. It becomes absorbed, and in this way probably acts topically on the secreting organs; for Mr. Hughes observes, that when a horse "that has been dosed with it begins to be warm upon his journey, the rider will smell the tar strongly." It is said to be an excitant to the lymphatic vessels and glands.

USES.—As an internal remedy, it is employed in chronic pulmonary affections (as winter coughs and old asthmas), in obstinate skin diseases (as lepra, psoriasis, and impetigo), and against tape-worm. Mr. Hughes says it is used in paralytic and nervous disorders.

As an external agent, it is applied to obstinate ulcers, as lupus and cutaneous diseases, and is employed as a stimulating liniment in chronic rheumatism, paralysis, and chilblains.

ADMINISTRATION.—The dose of Barbadoes petroleum is a small teaspoonful given in any convenient vehicle (as some aromatic water, tea, or spirit). The quantity should be gradually increased. An ounce has been taken in the day without any inconvenience.

¹ Trans. of the Roy. Soc. Edinb. vol. xiii. p. 1. ² The Natural History of Barbadoes, p. 50, Lond. 1750.

313. SUCCINUM, D. [U. S].—AMBER.

(The oil obtained by its destructive distillation, D.)

HISTORY.—Amber was known to Thales of Miletus, 600 years before Christ. He was the first to notice that, when rubbed, it acquired the power of attracting light bodies. Hence arose the term electricity, from *ἤλεκτρον*, *amber*. Theophrastus¹ also mentions this property.

NATURAL HISTORY.—Amber is found in different parts of the world. The principal portion of that met with in commerce comes from the southern coasts of the Baltic, in Prussia, and is cast on the shore between Königsberg and Memel. It is also found on the shores of Norfolk. It is supposed to be disengaged, by the action of the sea, from beds of lignite. The vegetable origin of amber is shown by various facts. It is usually associated with substances (bituminous wood, coal, &c.) known to be derived from plants. Externally we observe on it various impressions of the branches and bark of trees; and inclosed in it are insects and parts of plants (as the wood, leaves, flowers, and fruit). According to Sir David Brewster,² its optical properties are those of an indurated vegetable juice. From these circumstances, as well as from its chemical composition, amber is supposed to have been a resinous exudation from some tree. As the wood, leaves, blossoms, and fruit of some coniferous plant are found in amber, this plant has been supposed to be the amber tree; and a microscopic examination of the wood leads to the conclusion that the amber tree is a species, though probably an extinct one, of the genus *Pinus*, closely allied to *P. balsamea*.³ On chemical grounds, however, Liebig⁴ suggests that it is a product of wax, or of some other substance allied to the fats of fixed oils; since succinic acid is formed by the oxidation of stearic and margaric acids.⁵

PROPERTIES.—It occurs in irregularly shaped pieces, usually flat, and somewhat rounded at the sides. Its colour is yellowish-white (*succinum album*), yellow (*succinum citrinum*), or reddish (*succinum rubrum*). It is usually translucent, sometimes opaque or transparent; it is tasteless and odourless. Its sp. gr. is about 1.07. It is brittle, yields readily to the knife, has a conchoidal vitreous or resinous fracture, and becomes negatively electrical by friction; it contains various insects which, apparently, must have become entangled in it while it was soft and viscid. (For an account of these, consult Mr. Hope's paper before quoted; also Burmeister's *Manual of Entomology*, p. 574).

Heated in the air, amber fuses at about 550° F., then inflames, and burns with a yellow flame, emitting a peculiar odour, and leaving behind a light shiny black coal. It cannot be fused without undergoing some chemical change. It evolves water, volatile oil, and succinic acid; the residual mass is termed *colophonium succini*. By destructive distillation in a retort or alembic, amber yields first an acid liquor (which contains succinic and acetic acids), then some succinic acid is deposited in the neck of the retort, and an empyreumatic oil (*oleum succini*) comes over, at first thin and yellowish, afterwards brown and thick; towards the end of the operation, a yellow light sublimate is observed in the neck of the retort; this is called, by Berzelius, *crystallized pyréline*; by Vogel, *volatile resin of amber*; by Gmelin, *amber-camphor*. An inflammable gas is evolved during the whole time of the operation.

COMPOSITION.—The ultimate constituents of amber are, carbon, hydrogen, and oxygen. The proximate principles are, a volatile oil, two resins, succinic acid, and a bituminous substance.

¹ De Lapidibus.² *Edinburgh Philosophical Journal*, vol. ii.³ Hope, *On Succinic Insects*, in *Trans. Entom. Soc.* vols. i. and ii. See also Sendelius, *Historia Succinorum*, Lips. 1712.⁴ Turner's *Elements of Chemistry*, 7th edit. p. 1050.⁵ For farther details respecting the natural history of amber, consult John's *Naturgeschichte d. Succins*, Coln. 1816; and Graftenhauer's *Histoire Naturelle, chimique, et technique, du Succin*, Paris, 1821.

Ultimate Constituents.

	Drassier.	Ure.
Carbon	80.59	70.68
Hydrogen	7.31	11.62
Oxygen	6.73	7.77
Ashes (silica, lime, and alumina) . .	3.27	—
Amber	97.90	90.07

Proximate Constituents.

Berzelius.
Volatile Oil.
Two Resins.
Succinic Acid.
Bitumen.

Amber.

According to Hünefeldt, hydrochloric acid extracts from amber, besides succinic acid, another acid, very similar to *metallic acid*.

The *volatile oil* has a strong but agreeable odour. The *resins* are soluble in both alcohol and ether; if an alcoholic solution of the two resins be prepared by heat, and then allowed to cool, one of the resins is deposited. The *bituminous matter* constitutes the principal part of amber; it is insoluble in alcohol, ether, the oils, both volatile and fixed, and alkaline solutions.

CHARACTERISTICS AND PURITY.—The resins copal and animi are sometimes substituted for amber. They may be distinguished by the difference in their colour and fracture, and by their not emitting the peculiar odour of amber when thrown upon hot iron.¹ They do not yield succinic acid when submitted to distillation. Copal, during its combustion, is constantly falling in drops; and by this character may be distinguished from amber.²

PHYSIOLOGICAL EFFECTS.—Amber was formerly celebrated as a stimulant and antispasmodic. It probably possesses little or no medicinal power.

USES.—It is not employed as a medicine in this country. It was formerly used in chronic catarrhs, amenorrhœa, hysteria, &c., and was given either in the form of powder, in doses of from ten grains to a drachm, or in that of tincture, a formula for which is contained both in the French Codex and Prussian Pharmacopœia.

1. OLEUM SUCCINI, D. [U. S.]; Oil of Amber.—No directions for the preparation of this oil are given in the Dublin Pharmacopœia.

The following mode of preparing this oil I have seen practised by an experienced manufacturer: The amber is distilled in a large iron still or retort, set in brick-work over a proper fire, and connected with an earthen globe, which opens into an old oil jar for a receiver. Three distilled products are obtained; impure succinic acid, called *volatile salt of amber*; an aqueous liquor, termed *volatile spirit of amber*, consisting of water, acetic and succinic acid, and pyrogenous oil; and *volatile oil of amber*. The residue in the retort is a kind of pitch, and is called *English asphalt*. The oil is afterwards rectified by distillation in an iron pot, to which an earthen head is adapted. A very gentle heat suffices for re-distillation. Scrapings of Copal and the resin Dammar are frequently substituted for amber. They yield no succinic acid, but a volatile oil scarcely distinguishable from genuine oil of amber.

Volatile oil of amber, when fresh drawn, has a pale yellowish colour, which deepens by age, and a strong and remarkable, but agreeable odour. It is a powerful local irritant. When rubbed on the skin, it acts as a rubefacient, and is sometimes employed in liniments in rheumatism and paralysis. Taken internally, it operates, like most other empyreumatic oils, on the nervous system, and is used as a stimulant, antispasmodic, and emmenagogue, in hysteria and amenorrhœa. The dose is from ten to fifteen drops. It is a constituent of the *Tinctura Ammoniac composita*, which is made in imitation of *Eau de Luce*, the history of which has been fully detailed by Beckmann.³

ARTIFICIAL MUSK (*Moschus artificialis*; *Moschus factitius*) is prepared by adding gradually ʒiiss of concentrated nitric acid to ʒj of oil of amber, in a large glass tumbler. When the acid is not of sufficient strength, its action must be assisted by heat. The oil is gradually resinified at the expense of the oxygen of the acid, nitrous fumes being evolved. An orange yellow

¹ United States Dispensatory.

² Kidd's *Outlines of Mineralogy*, vol. ii. p. 33, Oxford, 1809.

³ *History of Inventions and Discoveries*, 2d edit. vol. iv p. 595, Lond. 1814.

resin, having a peculiar musky odour, is obtained; which is to be well washed with water to remove all traces of acid. Artificial musk is reputed to be antispasmodic and nervine, and has been employed in hooping-cough, and low nervous fevers. A tincture of it (*Tinctura Moschi artificialis*) is prepared by dissolving ʒj of artificial musk in fʒx of rectified spirit. The dose is fʒj.

2. **ACIDUM SUCCINICUM**; *Succinic Acid*, or the *Acid of Amber*; *Sal Succini*.—This acid is obtained in the distillation of amber. The mode of purifying it has been already stated. It may also be procured by the oxidation of stearic and margaric acids. It crystallizes in colourless white scales or prisms, which are quite volatile. Anhydrous succinic acid is composed of $C^4H^2O^3=50$. The sublimed acid is composed of $2\bar{S}+HO=109$. It is soluble in water; scarcely so in cold, but more so in boiling, alcohol. It is almost insoluble in oil of turpentine, by which it is distinguished from benzoic acid. Succinate of ammonia produces, with the salts of the sesquioxide of iron, a brownish-red flaky precipitate (*persuccinate of iron*), and, with the salts of lead, a white precipitate (*succinate of lead*). Succinic acid is said to possess stimulant and antispasmodic properties, and to promote perspiration and excretion of urine. It was formerly employed in rheumatism, gout, suppressed or repressed eruptions, and cramps. It is now never used in medicine. The dose in which it was formerly given was grs. v to grs. xv.

314. OLEUM ANIMALE EMPYREUMATICUM.—EMPYREUMATIC ANIMAL OIL.

When animal substances (as bone or hartshorn) are subjected to destructive distillation, a fetid volatile oil is obtained, which is commonly called *Animal* or *Dippel's Oil*. That which is found in commerce is obtained in the manufacture of bone black. It is identical in its nature with the *Oleum Cornu Cervi*, or *Oil of Hartshorn*, formerly used in medicine. As usually met with, it is a thick, brown, viscid oil, having a most repulsive odour. By distillation, however, it may be rendered colourless and limpid, but is soon altered by the action of air and light. Its ultimate constituents are *Carbon*, *Hydrogen*, *Nitrogen*, and *Oxygen*. It contains ammonia, and therefore has an alkaline reaction. Unverdorben alleges that it contains four oily salifiable bases, to which he has given the names of *odorine*, *animine*, *olanine*, and *ammoline*. Reichenbach has obtained *creasote* from it, and ascribes to this principle the supposed virtues of animal oil. Whatever may be its active principle, animal oil is undoubtedly a very powerful agent. In large doses, it acts as an energetic poison, operating in two ways, locally as an irritant, remotely as a narcotic.¹ Swallowed in moderate doses, it stimulates the vascular and nervous systems, and is esteemed antispasmodic. It has been employed as a local agent in bruises, gangrene, porrigo, and other diseases of the skin. Internally it has been used to prevent an attack of epilepsy or ague, as a stimulant in low fevers, and as an antispasmodic in hysteria and other affections of the nervous system accompanied with convulsive movements. Bremser² used *Chabert's oil* (prepared by mixing three parts oil of turpentine with one part Dippel's oil, and distilling three parts) as an anthelmintic in tape-worm. The dose of animal oil is a few drops, cautiously increased.

ORDER LXXIII. GUTTIFERÆ, *Jussieu*.—THE MANGOSTEEN TRIBE.

CLUSIACEÆ, *Lindley*.

CHARACTERS.—*Sepals* 2 or 6, usually persistent, round, frequently unequal, and coloured; æstivation imbricated. *Petals* hypogynous, 4 to 10. *Stamens* hypogynous, indefinite or rarely definite,

¹ Christison, *Treatise on Poisons*.

² *Traité sur les Vers Intestin*. Paris, 1824.

Fig. 402.

*Garcinia Mangostana.*

(Fig. 402) is the most delicious of East Indian fruits, and is "the only fruit which sick people are allowed to eat without scruple."

315. GARCINIÆ SPECIES INCERTA, L.—THE GAMBOGE PLANT.

Hebradendron cambogioides, Graham, *K. D.*—*Cambogia Gutta*, Linn.—*Stalagmitis cambogioides*, Moen.

Sex. Syst. ¹ Monœcia, Monadelphia.

(Gummi resina, L.—Gummy-resinous exudation, *E. D.*)

[*Gambogia*, *U. S.*]

HISTORY.—The first notice of gamboge is by Clusius,² in 1605. He received this gum-resin, in 1603, from Peter Garet, of Amsterdam. It had been brought from China by Admiral van Neck and his companions, and its oriental name was said to be *Ghittaiemou*.

Fig. 403.

*Hebradendron cambogioides.*

A. Male flowering branch.

1. Back view of a flower.

2. Side view of the calyx and column of stamens.

B. Fruit-bearing branch.

3. Section of fruit with its four seeds.

[**BOTANY.** *Gen. Char.*—*Flowers* polygamous. *Stamens* more or less united. *Anthers* opening longitudinally. *Fruit* succulent, 4- to 10-celled.

Hab.—Ceylon, Indian Archipelago.

The annexed cut represents the plant still adopted in the Edinburgh and Dublin Pharmacopœias as that yielding gamboge. The London College have agreed with Dr. Christison in considering the distinctive characters given by the late Dr. Graham insufficient to authorize a generic distinction, and so to separate the plant described by him from the genus *Garcinia*. The true gamboge plant appears to have been possessed by Dr. Almeida, of Singapore, who received it from Siam direct. It has not, however, been fully described.—*Ed.*]

The *Stalagmitis Cambogioides*, Murray,³ L.; *S. Cambogia*, Persoon, D. does not really exist. The specimen, which has been described as such, is in the Banksian Herbarium, and was found by Mr. Brown⁴ to consist of two plants (*Xanthochymus ovalifolius* of Roxburgh, and *Hebradendron cambogioides* of Graham), the

¹ As the female flowers have not yet been examined, the true place of this plant in the sexual system must at present be doubtful. Linnæus puts his genus *Cambogia* in *Polyandria Monogynia*.

² *Exot. lib. iv. cap. viii. p. 82.*

³ *Graham, Comp. to Bot. Mag. ii. 197.*

⁴ *Comm. Götting. ix. 169.*

union of which had been concealed by sealing-wax. As it appears, according to Dr. Christison,¹ that the gamboge of Siam is "as nearly as possible identical in composition and properties" with that of Ceylon, it is probable that both are obtained from the same, or some nearly allied species. Indeed, it has been suggested that the plant may have been carried from Siam to Ceylon; for the Bhoodist religion is supposed to have passed from the former to the latter country, and with it the practice of painting the temples and holy places with gamboge.

PREPARATION.—The only account which we possess of the method of obtaining Siam gamboge, is that given to König by a Catholic priest residing at Cochin-China.² According to this statement, when the leaves or branchlets are broken, a yellow milky juice issues *guttatim* (hence the origin of the term *Gummi Guttæ*, applied to gamboge), and is received either on the leaves of the tree, or in cocoa-nut shells, and from thence is transferred into large flat earthen vessels, where it is allowed to harden during the summer season, and is afterwards enveloped with leaves. The cylindrical or pipe variety receives its form by being run into the joints of the bamboo while it is in the liquid state.³ A few years since, there was an importation of gamboge in the bamboo cylinders (*gamboge in the bamboo*). Each cylinder or stem was about twenty-one inches long and one inch and a half in diameter, closed at the lower end by the transverse partition of the nodus, and at the upper by a piece of oil-skin. In Ceylon, gamboge is obtained by wounding the bark of the tree in various places with a sharp stone, when the flowers begin to appear. The cream-like juice which exudes hardens in the sun.⁴ According to Mrs. Walker, the Cingalese method of collecting it is "by cutting pieces of the bark completely off, about the size of the palm of the hand, early in the morning. The gamboge oozes out from the pores of the bark in a semi-liquid state, but soon thickens, and is scraped off by the collectors next morning, without injury to the tree, the wounds in the bark readily healing, and becoming fit to undergo the operation again."⁵

DESCRIPTION.—Two kinds of gamboge (*cambogia*; *gummi-guttæ*) are described by pharmacological writers—viz. the Siam and the Ceylon. Of these, the first only is known in commerce.

1. **Siam Gamboge** (*Cambogia Siamensis*, Ph. Ed.).—This is the *gamboge* of the shops. It is brought to this country sometimes direct from Siam; at other times, indirectly by way of Singapore, Penang, or Canton. It comes over in boxes, cases, or chests. In 1839, duty (4s. per cwt.) was paid on 15 cwt.; in 1838, on 40 cwt. It presents itself, in commerce, in three forms: 1st, *in rolls* or *solid cylinders*; 2dly, *in pipes* or *hollow cylinders*; 3dly, *in cakes* or *amorphous masses*. Both the solid and hollow cylinders are known in commerce as *pipe gamboge*. What is called *coarse gamboge* consists of the commonest pieces of the above.

a. *Pipe gamboge* consists of cylindrical pieces, varying in size from one to three inches in diameter. Some of them appear to have been formed by rolling; but many of them are striated, from the impression of the bamboo stems, into the hollow of which the gamboge juice has been run, and not unfrequently portions of the stems are still adherent; and on one occasion, as above-mentioned, the gamboge was imported in the stems (*gamboge in the bamboo*). The gamboge cylinders are sometimes distinct, and covered externally with a dirty greenish-yellow dust; at others, agglutinated, or even folded, so as to form masses of varying sizes and forms. Pipe gamboge occurs in all qualities; the finest and the worst specimens of gamboge which I ever saw having this form. *Fine gamboge* is brittle and odourless; it has very little taste at first, but, after some time, it causes a sensation of acridity in the throat. Its fracture is conchoidal; its fractured surface is opaque, reddish-yellow, with a glimmering lustre. It is completely dissolved by the successive action of ether and water. Mixed with a sufficient quantity of water, it forms a yellow emulsion, the films of which are excellent microscopic objects for observing the *active*

¹ *Comp. to the Bot. Mag.* vol. ii. p. 236.

² White, *Voyage to the China Seas*, Boston, 1823, p. 250, quoted by Dr. A. T. Thomson, in *Lond. Disp.*

³ Murray, *op. cit.* pp. 108 and 657.

⁴ Murray, *App. Med.* iv. 656.

⁵ Graham, *op. supra cit.* p. 196.

molecules described by Mr. R. Brown.¹ The powder of fine gamboge is bright yellow. The *Edinburgh College* gives the following characters of pure gamboge:—

"Fracture somewhat conchoidal, smooth, and glistening; a decoction of its powder, cooled, is not rendered green by tincture of iodine, but merely somewhat tawny."

The iodine is employed to prove the absence of starch. *Inferior qualities* of gamboge are harder, more earthy in fracture; the fractured surface is brownish or grayish-yellow, frequently with black spots, from the presence of foreign bodies which are intermixed. It is not completely dissolved by the successive action of ether and water. Iodine readily detects, in the cooled decoction, starch, by the green colour which it gives rise to.

3. *Lump or Cake Gamboge* occurs in masses of several pounds weight. Its quality is inferior to the finest pipe kind. Internally we observe fragments of wood, twigs, and air-cells. In most of its characters it agrees with the inferior qualities of pipe gamboge, and like this contains starch.

2. *Ceylon or Cingalese Gamboge* (*Cambogia Zeylanica*, Ph. Ed.).—I am unacquainted with this kind of gamboge, which is unknown in English commerce. Dr. Christison says that, as he has seen it, it "is usually in small irregular fragments, but, as originally collected, is in flattish round masses, as if moulded in shallow bowls, weighing about a pound or upwards; and it appears to be composed of aggregated irregular tears, with interspaces and cavities, which are lined with a dark powdery matter, or with a powder of an earthy appearance. Altogether it seems a very coarse article." It forms, "with great ease, an emulsion nowise inferior in smoothness, and very little, if at all, in liveliness of tint, to that of the very best Pipe Gamboge of Siam."

COMPOSITION.—Gamboge was analyzed, in 1808, by Braconnot;² in 1813, by John;³ and in 1836, by Dr. Christison.⁴

	Siam Gamboge.						Ceylon Gamboge.		
	Cylindrical or pipe.		Cake or Lump.		Coarse.				
	First.	Second.	First.	Second	First.	Second.	First.	Second.	Third.
Resin	74.2	71.6	64.3	65.0	61.4	35.0	68.8	71.5	72.9
Soluble gum . .	21.8	24.0	20.7	19.7	17.2	14.2	20.7	18.8	19.4
Woody fibre . .	trace.	trace.	4.4	6.2	7.8	19.0	6.8	5.7	4.3
Fecula	—	—	6.2	5.0	7.8	22.0	—	—	—
Moisture	4.8	4.8	4.0	4.2	7.2	10.6	4.6	{ not ascer- tained.	not ascer- tained.
Gamboge	100.8	100.4	99.6	100.1	101.4	100.8	100.9	96.0	96.6

1. **GAMBOGIC ACID;** *Gambogic Acid*, Johnston; *Resin*, Christison.—Obtained by evaporating to dryness the ethereal tincture of the pure gum-resin. It is brittle, in thin layers of a deep orange colour, in thicker masses of a cherry-red tint. It is insoluble in water, but soluble in alcohol, and still more so in ether. It communicates an appreciable yellowness to 10,000 times its weight of spirit. It is soluble in the caustic alkalies, forming dark red solutions (*alkaline gambogiates*), which yield, with acids, a yellow precipitate (*gambogic acid*); with acetates of lead, a yellow (*gambogiate of lead*); with the salts of iron, a dark-brown (*gambogiate of iron*), and with sulphate of copper, a brown one (*gambogiate of copper*). The composition of gambogic acid, according to Johnston,⁵ is $C^{40}H^{23}O^8$. When heated to about 400° F. it undergoes partial decomposition, a resin soluble in cold alcohol being formed, and another insoluble in that liquid. The constitution of the latter seems to be represented by $C^{40}H^{22}O^9$.—In doses of five grains, gambogic acid occasioned profuse watery discharges, without pain or other uneasiness. If the activity of gamboge depended solely on the resin, five, or five and a half, grains of the resin should be equal to seven of gamboge; but, according to Dr. Christison, this is not the case.

¹ *Phil. Mag.* for Sept. 1828 and 1829.

² Gmelin, *Hand. de Chem.* ii. 626.

³ *Phil. Trans.* 1839.

⁴ *Ann. de Chim.* lxxviii. 33.

⁵ *Companion to the Botanical Magazine*, ii. 233.

Hence, either it is not the sole active ingredient, or it becomes somewhat altered in the process for procuring it; the latter supposition is the more probable.

2. GUM (*Arabine?*).—The gum of gamboge is soluble in water, like gum Arabic.

3. STARCH or *Fecula*.—This substance, which is found in common gamboge, is doubtless an adulterating substance.

CHEMICAL CHARACTERISTICS.—Gamboge emulsion becomes transparent and deep red on the addition of potash, forming *gambogiate of potash*. Digested in alcohol or ether, gamboge yields orange-red tinctures (*solutions of gambogic acid*). The ethereal tincture dropped on water yields, on the evaporation of the ether, a thin, bright yellow, opake film or scum (*gambogic acid*), soluble in caustic potash. The alcoholic tincture dropped into water yields a bright, opake, yellow emulsion, which becomes clear, deep red, and transparent, on the addition of caustic potash. The gambogiate of potash (obtained by any of the above processes) gives, if the alkali be not in excess, with acids, a yellow precipitate (*gambogic acid*); with acetate of lead, a yellow precipitate (*gambogiate of lead*); with sulphate of copper, brown (*gambogiate of copper*); and with the salts of iron, dark brown (*gambogiate of iron*).

The detection of gamboge in pills has become, on some occasions, an important object of medico-legal research.¹ Spurious *extractum colocynthis compositum*, and the *pill cochæ* of the shops, sometimes contain gamboge. The mode of detection, in all these cases, is simple: Digest one portion of the suspected substance in alcohol, and another in ether. Then subject the alcoholic and ethereal tinctures to the tests above mentioned.

In external appearance, the resin of *Xanthorrhæa hastile* is the only substance that could, by a remote possibility, be confounded with gamboge. But the above chemical characters readily distinguish gamboge. They would also prevent the yellow colouring matter of saffron, of turmeric, and of rhubarb, from being confounded with that of gamboge.

PHYSIOLOGICAL EFFECTS. *a. On Animals generally*.—The animals on which the effects of gamboge have been tried, are dogs, horses, oxen, sheep, and rabbits. From his experiments on dogs, Orfila² inferred that it is a powerful local irritant; and that when applied to any of the animal tissues, its fatal operation depends, not on its absorption, but on its powerful local action, and on the sympathetic irritation of the nervous system. It appears to be an uncertain and dangerous medicine for herbivorous animals, and is, therefore, never employed by veterinarians. Daubenton states, that two drachms killed a sheep.³ Two ounces and a half have been found to produce very little effect on a cow; while twice that quantity caused dysentery, which continued seventeen days. On the horse, from six to twelve drachms have merely rendered the stools somewhat softer and more frequent, although shivering, loss of appetite, irregularity of pulse, great anxiety, and other alarming constitutional symptoms were brought on.⁴ On the other hand, Viborg⁵ has given an ounce to the horse without any remarkable effect.

β. On Man.—Taken in *small doses*, gamboge promotes the secretions of the alimentary canal and of the kidneys, and causes more frequent and liquid stools than natural. In *larger doses*, it occasions nausea, oftentimes vomiting, griping pains of the bowels, watery stools, and increased discharge of urine. When the action is very violent, there is great depression of the vascular system. In *excessive doses*, it acts as an acrid poison. A drachm caused horrible vomiting and purging, followed by syncope and death.⁶ The deaths which have occurred from the use of enormous quantities of Morison's pills⁷ are mainly ascribable to the gamboge contained in these medicines. In these cases, the symptoms were violent vomiting and purging, abdominal pain and tenderness, cold extremities, and sinking pulse. On *post-mortem* examination, inflammation, ulceration, and mortification of the intestines, were found.

Gamboge belongs to the active hydragogues and drastic purgatives. Its activity

¹ Trial of Joseph Webb, at York Summer Assizes, 1834, taken by Mr. Frazer, Lond. 1834.

² Toxicol. Gén.

³ Moiroud, Pharm. Vét. p. 267—8.

⁴ Paullini, Eph. Nat. Cur. Dec. i. Ann. viii. p. 139.

⁵ Wibmer, Wirk. der Arzneim. u. Gifte, ii. 359.

⁷ See Lond. Med. Gaz. vol. xiv. 612 and 759; xvii. 357, 415, and 623; xviii. 75 and 297, and xix. 976.

is inferior to elaterium and croton oil. In acridity it exceeds jalap, scammony, and even colocynth. In its mode of operation it is allied to, though scarcely so acrid as euphorbium. It is exceedingly apt to irritate the stomach, and to occasion nausea and vomiting. This arises from its ready solubility in the gastric juices. As this action on the stomach is exceedingly objectionable, we sometimes endeavour to lessen it by conjoining aloes, or some other substance which diminishes the solubility of gamboge in aqueous fluids, and by giving the medicine in the form of pill. Sundelin¹ ascribes to gamboge an especial power of exciting the vascular system (arteries and veins) of the pelvic organs, in virtue of which, he says, it readily gives rise to the hemorrhoidal flux and uterine hemorrhage. Farthermore, he regards it as powerfully irritating and exciting to the abdominal nerves, especially the sacral and pelvic divisions.

USES.—From the foregoing account of the effects of gamboge, it is very evident that it is a remedy well adapted for acting as a stimulus to the abdominal and pelvic viscera, either to rouse them when in a torpid state, or to give them preternatural activity, and thereby to relieve some distant organ, on the principle of counter-irritation. On the other hand, the use of gamboge is highly objectionable when there is an irritable or inflammatory condition of the stomach or bowels, a tendency to abortion, or to uterine hemorrhage, and also when we do not want to promote or increase the hemorrhoidal discharge. The following are some of the cases in which we employ it:—

1. *In constipation*, where an active cathartic of small bulk is required, gamboge is employed. It is, however, not given alone, as the necessary dose would be very apt to create nausea and vomiting. It is, therefore, usually conjoined with other and milder purgatives, the operation of which it increases and quickens, while they, by diminishing its solubility in the juices of the stomach, lessen its tendency to create nausea or vomiting. The *Pilulæ catharticæ compositæ*, Ph. U. S., and the *Pilulæ gambogiæ compositæ*, L. D., may be referred to as preparations in which these objects have been kept in view.

2. *In cerebral affections*, as apoplexy, or a tendency thereto, gamboge, usually associated with other purgatives, as above stated, is a highly valuable counter-irritant purgative. By stimulating and rousing the nerves, bloodvessels, and secretory apparatus of the abdomen, it is often calculated to relieve determinations of blood to other parts.

3. *In dropsies*, gamboge has been employed, on account of its hydragogue operation, where the use of drastic purgatives is indicated. To its efficacy numerous practitioners have borne testimony. It is, however rarely given alone, but usually in combination with other and milder remedies (as jalap and bitartrate of potash) of the same class. If it be desirable to act also on the kidneys, an alkaline solution of gamboge has been recommended. Gamboge has been thought more especially serviceable in those forms of dropsy connected with hepatic obstruction.

4. *As an anthelmintic*, gamboge has been frequently employed as a remedy for tapeworm, and not unfrequently with considerable success. Several empirical anthelmintic remedies² are said to owe their efficacy to this substance. It is an important constituent of Madame Nouffer's *specific*.

ADMINISTRATION.—On account of its tendency to occasion vomiting and griping, gamboge is usually given in *small doses*, as from one to three or four grains, in the form of pill, and repeated every four or six hours. In this way, it may be given with safety and without inconvenience. The full dose of it is said to be from ten to fifteen grains. An alkaline solution of gamboge has been long known on the continent under the name of *tincture of gamboge* (*tinctura gummi guttæ*),³ and has been employed as a powerful diuretic in dropsy. It consists of gamboge, in powder, ℥ss; carbonate of potash ℥j (intimately mixed with the gamboge); and brandy ℥xij. Digest with a gentle heat for four days.—Dose f℥ss to f℥j.

¹ *Heilmittel*. ii. 28, 3te Aufl.

² In Voigtel's *Arzneim.* Bd. ii. Abt. ii. S. 203.

³ See Murray, *App. Med.* iv. 121, et seq.

ANTIDOTE.—In poisoning by gamboge, our chief reliance must be placed on the palliatives already mentioned for poisoning by euphorbium and elaterium. I am acquainted with no well-ascertained antidote, though the alkalies (carbonate of potash, according to Hahnemann¹) have been said to diminish the violence of the topical action of gamboge.

PILULÆ CAMBOGIÆ COMPOSITÆ, L.; *Pilulæ Cambogiæ*, E.; *Gamboge Pills*.—(Gamboge, bruised, ℥ij [one part, E.]; Socotrine or Hepatic Aloes, bruised, ℥iij [East Indian or Barbadoes Aloes, one part, E.]; Ginger, bruised, ℥j [Aromatic powder, one part, E.]; Soft Soap ℥ss [Castile Soap, two parts, E.]. Mix the powders together, then add the soap [and then a sufficiency of syrup, E.], and beat them into one mass.)—Cathartic—considerably more active than the *Pilulæ Aloes compositæ*. Employed in obstinate constipation.—Dose, grs. x to grs. xv.—The aloes, by diminishing the solubility of the gamboge, renders the latter less likely to irritate the stomach. The formula is said to be a simplification of one proposed by Dr. George Fordyce.

316. CANELLA ALBA, Murray, L. E. D.—LAUREL-LEAVED CANELLA, OR WILD CINNAMON.

Sez. Syst. Dodecandria, Monogynia.

(Cortex, L.—Bark, E. D.)

[Canella, U. S.]

HISTORY.—The bark of this tree has been frequently confounded with that of *Drimys Winteri*, hereafter to be described. Clusius² describes both barks, and notices two kinds of canella bark.

BOTANY. **Gen. Char.**—*Sepals* 5. *Petals* 5; somewhat coriaceous, glaucous-blue, contorted in æstivation. *Stamens* united to form a tube; *anthers* 15, resembling furrows. *Stigmas* 3. *Berry* 3-celled, or by abortion 1-celled; cells 1- or 2-seeded. *Embryo* (according to Gaertner, but perhaps an error) surrounded by fleshy albumen, curved, with linear cotyledons. (De Cand.)

Sp. Char.—The only species.

A tree, growing from 10 to 50 feet high. *Leaves* alternate, shining, obovate, cuneate at the base, coriaceous and opaque when old, dotted when young. *Flowers* small, clustered, purple. *Berry* the size of a pea, fleshy, smooth, blue or black.³

Hab.—West Indies and continent of America.

DESCRIPTION.—The canella bark of the shops (*cortex canellæ albæ*), sometimes termed on the continent *costus dulcis* or *costus corticosus*, is the inner bark of the stem and branches. It occurs in quills or broken pieces, which are hard, somewhat twisted, of a yellowish-white or pale orange-colour, somewhat lighter on the internal surface, and have an aromatic clove-like odour, an acrid peppery taste, and a white granular fracture.

J. Bauhin and others have confounded it with *Winter's bark*; hence it has been denominated *spurious Winter's bark* (*cortex Winteranus spurius*). The pale colour of its inner surface is one out of several physical characters by which the two barks may be distinguished. Chemically they may be distinguished by nitrate of baryta and sulphate of iron, both of which cause precipitates in the infusion of Winter's bark, but not in that of canella.⁴

COMPOSITION.—Canella bark was analyzed, in 1820, by Henry;⁵ and in 1823, by Petroz and Robinet.⁶

¹ *Hufeland's Journ.* Bd. v. S. 12.

² Swartz, *Trans. Linn. Soc.* i. 96.

³ *Ibid.*

⁴ *Ezot. lib. iv. cap. i. p. 75, and cap. iii. p. 78.*

⁵ *Journ. de Pharm.* t. v. p. 481.

⁶ *Op. cit.* vol. viii. p. 197.

Henry's Analysis.

Volatile oil.
 Aromatic resin.
 Brownish-yellow colouring matter.
 Extractive.
 Gum.
 Starch.
 Albumen.
 Lignin.
 Salts.

Canella Bark.

Petroz and Robinet's Analysis.

Volatile oil.
 Resin.
 Bitter extractive.
Canellin.
 Gum.
 Starch.
 Albumen.
 Lignin.
 Salts.

Canella Bark.

1. **VOLATILE OIL OF CANELLA BARK**—According to Cartheuser, it is dark yellow, fluid, and heavier than water. It has an acrid taste.

2. **RESIN**.—Henry found this constituent to be aromatic, but not acrid.

3. **BITTER EXTRACTIVE**.—Brown, very bitter, not crystallizable. Soluble in alcohol, ether, and slightly in water.

4. **CANELLIN**.—(*Mannite?*).—A crystallizable, saccharine substance, incapable of undergoing the vinous fermentation.

PHYSIOLOGICAL EFFECTS.—Canella bark is an aromatic stimulant and tonic. Its aromatic qualities depend on the oil and resin; its tonic properties on its bitter principle. As an aromatic, it ranks between cinnamon and cloves.

USES.—In this country it is employed principally as an aromatic addition to purgatives and tonics, as *Vinum aloës*, and *Tinctura gentianæ composita*, E., and *Vinum gentianæ*, E.; and is well adapted for debilitated conditions of the digestive organs. [The *Pulvis aloës cum canella*, of former pharmacopœias, was, and still is, a very favourite popular remedy.—Ed.]

By the Caribs (the ancient natives of the Antilles) and the negroes of the West Indies it is employed as a condiment. It has been considered useful in scurvy.

ADMINISTRATION.—Dose of the powder, grs. x to ʒss.

VINUM GENTIANÆ, E.; *Wine of Gentian*.—(Gentian, in coarse powder, ʒss; Yellow Bark, in coarse powder, ʒj; Bitter Orange-peel, dried and sliced, ʒij; Canella, in coarse powder, ʒj; Proof Spirit fʒivss; Sherry Oj, and fʒxvj. Digest the root and barks for twenty-four hours in the spirit; add the wine, and digest for seven days more; strain and express the residuum strongly, and filter the liquors.)—Wine of gentian is an aromatic tonic, useful in dyspepsia and anorexia. It is apt to become acetous by keeping.—The dose of it is fʒss to fʒj.

ORDER LXXIV. AURANTIACEÆ, *Corréa*.—THE ORANGE TRIBE.

CHARACTERS.—*Calyx* urceolate or campanulate, somewhat adhering to the disk, short, 3- or 5-toothed, withering. *Petals* 3 to 5, broad at the base, sometimes distinct, sometimes slightly combined, inserted upon the outside of a hypogynous disk, slightly imbricated at the edges. *Stamens* equal in number to the petals, or twice as many, or some multiple of their number, inserted upon a hypogynous disk; *filaments* flattened at the base, sometimes distinct, sometimes combined in one or several parcels; *anthers* terminal, innate. *Ovary* many-celled; *style* 1, taper; *stigma* slightly divided, thickish. *Fruit* pulpy, many-celled, with a leathery rind, replete with receptacles of volatile oil, and sometimes separable from the cells; *cells* often filled with pulp. *Seeds* attached to the axis, sometimes numerous, sometimes solitary, usually pendulous, occasionally containing more embryos than one; *raphe* and *chalaza* usually very distinctly marked; *embryo* straight; *cotyledons* thick, fleshy; *plumule* conspicuous.—*Trees* or *shrubs*, almost always smooth, and filled everywhere with little transparent receptacles of volatile oil. *Leaves* alternate, often compound, always articulated with the petiole, which is frequently winged. *Spines*, if present, axillary (Lindley).

PROPERTIES.—In the bark, leaves, flowers, and rind of the fruit, are numerous vesicular or rounded reservoirs, which contain a highly fragrant volatile oil. Pulp of the fruit acidulous and refrigerant.

317. CITRUS MEDICA, *Risso, E.*¹— THE CITRON TREE.*Sex. Syst.* Polyadelphia, Polyandria.

HISTORY.—The fruit of this species is supposed to be the *μῆλον μηδικόν* of Theophrastus.² Pliny³ calls it *malum citreum*. It is probable the citron is referred to in the Old Testament on several occasions,⁴ where, in our translation, the word apple has been employed.⁵

BOTANY. **Gen. Char.**—*Flowers* usually with a quinary proportion of parts. *Calyx* urceolate, 3- to 5-cleft. *Petals* 5 to 8. *Stamens* 20 to 60; *filaments* compressed, more or less united at the base, polyadelphous; *anthers* oblong. *Style* terete; *stigma* hemispherical. *Fruit* baccate, 7- to 12-celled; cells many-seeded, pulpy. *Spermoderms* (seed coats) membranous; auricles of the *cotyledons* very short. (De Cand.)—*Trees* or *shrubs*, with axillary spines. *Leaves* reduced to one terminal leaflet at the apex of the petiole, often winged. The rind of the fruit is regarded by De Candolle as a kind of torus, by Dr. Lindley as the union of the epicarp and sarcocarp. In the external yellow portion (*flavedo* or *zeste*) of it are the rounded or vesicular receptacles containing volatile oil; the inner white portion is spongy. The cells of the fruit are filled with small pulpy bags, readily separable from each other, and containing the acid juice. *Seeds* ex-albuminous, marked externally with the raphe; inner coat stained at one extremity, indicating the place of the chalaza.

Sp. Char.—*Petioles* naked. *Leaves* oblong, acute. *Flowers* with 40 anthers, often without pistils. *Fruit* oblong, rugous, with a thick rind and acidulous pulp. (De Cand.)—*Tree*. Young branches violet. *Leaves* subserrate. *Petals* externally purplish. *Fruit* large, violet-red when young, fine yellow when mature; its rind adherent, with an agreeable odour. Risso⁶ enumerates three varieties.

Hab.—A native of Asia. Cultivated in the South of Europe.

DESCRIPTION, &c.—The fruit of this tree is the *citron* (*malum citreum*). It sometimes attains a weight of more than 20 lbs. Those fruits which preserve their pistilla are called *pitima*. Risso says they are sought after by the Jews, who suspend them to palms at the Feast of the Tabernacle. The flavedo of the citron abounds in volatile oil, which may be obtained either by expression or distillation. The leaves, as also the flowers, of the citron-tree, yield a volatile oil by distillation.⁷ The leaves are interposed between linen, to which they communicate a fragrant odour; moreover, they are said to keep away insects.

Two volatile oils, known respectively as the *essence* or *essential oil* of citron, and the *essence* or *essential oil* of cedra, are employed in perfumery. Both are highly fragrant, almost colourless, and lighter than water. They are distinguished by their odour; that of the essence of cedra combining the odours of citron and bergamot. These two oils are usually confounded by pharmacological writers. From their apparent freedom from mucilage, I presume both have been procured by distillation. The composition of one of these has been ascertained by Dumas,⁸ to be identical with that of the essential oil of lemons, *viz.* C¹⁰H⁸.

PHYSIOLOGICAL EFFECTS AND USES.—Analogous to those of the orange and lemon. The fruit is seldom brought to the table in the raw state, but it yields some

Fig. 404.

*Citrus medica.*

¹ In the Edinburgh Pharmacopœia of 1839, and also in that of 1841, *Lemons* are referred to *Citrus medica*, Risso (De Cand.). This is an error.

² *Hist. Plant.* i. 22. and iv. 4.

³ *Cant.* ii. vii. and viii.; *Joel*, i.

⁴ *Ann. du Mus. d'Hist. Nat.* xx.

⁵ *Traité de Chimie*, v. 672.

⁶ *Hist. Nat.* xv. 14, ed. Vulp.

⁷ Carpenter, *Script. Nat. Hist.*

⁸ Raybaud, *Journ. de Pharm.* Août, 1831, p. 437.

excellent preserves and sweetmeats. The juice is employed to flavour punch and negus. It forms, with sugar and water, a refreshing refrigerant beverage. The essential oil is used in perfumery, and may be employed in medicine for scenting.

318. CITRUS BERGAMIA, *Risso*.—THE BERGAMOT CITRUS.

Citrus limetta, *E*.

Sex. Syst. Polyadelphia, Polyandria.

(Volatile oil of the rind of the fruit, *E*.)

BOTANY. *Gen. Char.*—See *Citrus medica*.

Sp. Char.—*Leaves* oblong, more or less elongated, acute or obtuse, underside somewhat pale. *Petiole* more or less winged or margined. *Flowers* usually small, white. *Fruit* pale yellow, pyriform or depressed; rind with concave receptacles of oil; pulp more or less acid (*Wight and Arnott*).

Hab.—Cultivated in the South of Europe.

DESCRIPTION.—The volatile oil or essence of bergamot (*oleum bergamii*, *oleum bergamotæ*), imported from the South of Europe, is procured from the rind of the fruit. It may be obtained either by expression (as the volatile oil of lemons) or by distillation.¹ It is pale greenish-yellow, with a remarkable odour, and a sp. gr. of 0.885. Its composition is identical with that of oil of lemons, being $C^{10}H^8$.

USES.—Oil of bergamot is employed as a perfume only. It is a useful odoriferous adjunct to unguents.

319. CITRUS LIMONUM, *Risso*, *L. E. D.*²—THE LEMON TREE.

(Fructûs cortex exterior; Oleum volatile è fructûs cortice expressum; Succus recens et exsiccatus, *L*.

Fruit; Rind of the fruit; Volatile oil of the rind of the fruit, *E*.

Fructûs succus, tunica exterior et ejus oleum volatile, *D*.)

Fig. 405.



Citrus Limonum.

a. Flower. b. Fruit divided.

HISTORY.—It is supposed that the Greeks and Romans were unacquainted with the orange and lemon, which only became known to Europeans at the time of the Crusades.³ This supposition receives confirmation from the fact, “that the Persian and Arabian authors do not, as is their wont, give any Greek synonyme of either, but of the citron, which is supposed to have been known to the Romans.”⁴

BOTANY. *Gen. Char.*—See *Citrus medica*.

Sp. Char.—Young branches flexible. *Leaves* oval or oblong, usually toothed. *Petiole* simply margined. *Flowers* white, tinged with red. *Fruit* yellow, ovoid or rarely globular; terminated by a more or less elongated knob; rind with convex vesicles of oil; pulp acid (*Wight and Arnott*).

Hab.—A native of Asia (*Himalaya*, *Royle*; *Persia*, *Risso*). Cultivated in the South of Europe.

DESCRIPTION, COMPOSITION, PRO.

¹ Raybaud, *Journ. de Pharm.* Août, 1834.

² In the *Edinburgh Pharmacopœia*, limes are erroneously referred to this species.

³ Macfadyen, in *Hooker's Bot. Miscel.* vol. i. p. 299.

⁴ *Royle, Illustr.* p. 130.

PERTIES, AND USES.—Lemons (*limones*) are imported from Spain, Portugal, Italy, and the Azores, packed in chests, each lemon being separately rolled in paper. The Spanish lemons are most esteemed. We employ in medicine both *the rind and the juice*.

1. **Lemon Peel** (*Cortex Limonum*, L. E. D.).—The flavedo (*flavedo corticis limonum*) is pale yellow and rough. By drying, its colour deepens. Its taste is aromatic and bitter; its odour, which is owing to the volatile oil lodged in appropriate receptacles, is strong and peculiar. The inner portion of the cortex is white, spongy, and almost both odourless and tasteless. The flavedo yields, both by distillation and expression, a volatile oil (*essential oil of lemons*). A watery infusion of lemon peel becomes greenish-brown on the addition of the sesquichloride of iron.

Lemon peel has not been regularly analyzed, though some of its constituents have been examined. It contains *volatile oil, hesperidin, a bitter principle, and gallic acid*.

1. **VOLATILE OIL**.—(See p. 977.)

2. **HESPERIDIN**.—A crystallizable, neutral, resinous (?) principle, which resides in the white portion of the rind of the fruit of the genus *Citrus*. It has the form of silky needles, which are odourless and tasteless, when pure, though they usually possess slight bitterness, probably from the presence of another principle. It is fusible, slightly soluble in water, but more so in alcohol; insoluble in ether, and the oils, both fixed and volatile. Oil of vitriol reddens it.¹

3. **BITTER MATTER** (*Aurantin*).—This is referred to the class of substances vaguely denominated extractive. It is the presence of this substance which enables an aqueous solution of impure hesperidin to form a reddish-brown precipitate with the persalts of iron. It frequently contains traces of gallic acid.

Lemon peel is a grateful stomachic and aromatic. It is employed more as a flavouring ingredient than for its own proper effects. It is a constituent of the *Infusum gentianæ compositum*, and of the *Infusum aurantii compositum*. *Candied lemon peel* (*cortex limonum conditus*) is an agreeable stomachic, and is employed as a dessert and in confectionery.

2. **Lemon Juice** (*Succus Limonum*, L. [U. S.]).—A slightly turbid, very sour liquor, with a grateful flavour, obtained from lemons by expression and straining. Owing to the mucilage and extractive which it contains, it readily undergoes decomposition, though various methods have been proposed of preserving it. On this account, an *artificial lemon juice* has been proposed as a substitute. The juice, both of lemons and limes (the fruit of *Citrus Lima*, Macfadyen, or *C. acida*, Roxburgh), is extensively imported. In 1839, duty of one halfpenny per gallon was paid on 37,338 gallons of these juices. In the West Indies *lime juice*, is preferred to lemon juice.

According to Proust, *lemon juice* consists of *citric acid*, 1.77; *malic acid, gum*, and *bitter extractive*, 0.72; and *water*, 97.51. *Lime juice* contains the same ingredients, in somewhat different proportions: the quantity of citric acid in it is larger, while that of mucilage, &c. is less.

CITRIC ACID.—(See *ante*, p. 947.)

Lemon juice furnishes a most agreeable and refreshing beverage, and proves refrigerant and antiscorbutic. It is employed for several purposes, as follows:—

a. *In the preparation of refrigerant drinks*.—It may be either added to barley-water, or mixed with sugar and water to form *lemonade*. The latter may be extemporaneously made, by adding two lemons sliced, and two ounces of sugar, to two pints of boiling water, and digesting until cold. A similar beverage is called, by Mr. Brande,² *King's Cup*. These acidulated drinks are exceedingly useful for allaying thirst, and as refrigerants in febrile and inflammatory complaints, and in hemorrhages. In the latter maladies, *iced lemonade* should be preferred. Where there is nausea or a tendency to sickness, *effervescent lemonade* is useful. “Lemonade, as a beverage in putrid diseases, was first introduced by the French physicians in the beginning of the seventeenth century; and about the year 1660, an Italian

¹ Hebreton, *Journ. de Pharm.* xiv. 377.

² *Diet. of Pharm.* 341.

from Florence, having learnt a process of freezing confectionery, conceived the happy idea of converting such beverage into ice. This found a ready sale, and was the occasion of so great an increase in the number of sellers of lemonade, that, in the year 1660, the *Lemonadiers* of Paris were formed into a company, and received a patent from the Government.¹

3. *In the formation of the effervescing draught.*—The effervescing draught, made with lemon juice (or citric acid) and bicarbonate of potash, is one of the best remedies we possess for allaying sickness and vomiting. The citrate of potash, which is formed, is a mild diaphoretic and diuretic, and often allays restlessness and watchfulness in fever. It is adapted for lithic acid deposits; but, like other remedies of the same class, is sometimes objectionable in phosphatic deposits. When our object is to determine to the skin, an effervescing draught, composed of lemon juice or citric acid and sesquicarbonate of ammonia, is to be preferred. The relative proportions of the alkaline carbonates, and of lemon juice or citric acid, for the formation of effervescing draughts, is as follows:—

<i>Citric Acid. Lemon Juice.</i>		<i>A Scruple of the Alkali.</i>
Grains 14	or fʒiiss	Bicarbonate of Potash.
Grains 17	or fʒiv	Carbonate of Potash.
Grains 24	or fʒvj	Sesquicarbonate of Ammonia.

Effervescing draughts are exceedingly valuable vehicles for the exhibition of other remedies.

γ. *As an Antiscorbutic.*—Lemon juice has long been regarded as an invaluable antiscorbutic; but on account of the difficulty of preserving it, crystallized citric acid is usually substituted. “Those only,” says Sir Gilbert Blane,² “who have made themselves acquainted with the early part of the naval history of this country, or those who have perused the interesting, popular, and eloquent narrative of Commodore Anson’s voyage, can duly appreciate the value of this simple remedy.” Yet, on hypothetical grounds, Dr. Stevens³ ventures to assert that citric acid produces scurvy!

δ. *As an Antidote.*—In poisoning by the alkalies and their carbonates, the vegetable acids are the antidotes; and the most convenient, easily procurable acidulous substances are, in general, vinegar and lemon juice.

ε. *As an Anti-narcotic.*—In poisoning by narcotic substances, as opium, lemon juice may be administered, after the poison has been removed from the stomach, to counteract the effects.

[*In Rheumatism.*—Lemon juice has been recommended as a remedy in acute rheumatism and gout by Dr. Owen Rees, and has been used with success by many practitioners, not only in this country, but in Italy, France, and America. Dr. Rees considers the citric acid to undergo changes in the stomach, and to supply oxygen to such elements as tend to produce uric acid, and thereby to induce the formation of urea and carbonic acid instead.—ED.]

ζ. *Other Uses.*—Several of the medicinal uses of lemon juice can only receive a passing notice. Such are, the employment of it, with common salt, in *dysentery*, *remittent fever*, *bellyache*, and *putrid sore-throat* as recommended by Dr. Wright;⁴ its use in *cardialgia*, by Dr. Dewees; and in *syphilis*, by Dr. Rollo. As a *topical remedy for uterine hemorrhage*, after delivery, Dr. Evratt⁵ recommends that a cut peeled lemon be introduced into the uterus, and the juice there expressed. It causes uterine contractions, by which the juice is expelled and the hemorrhage stopped. In *hospital gangrene*, Dr. Werneck⁶ applied, with good effect, in the first stage of the disease, either lint soaked in lemon juice, or segments of lemons.

ADMINISTRATION.—The mode of employing lemons will be obvious from the preceding remarks.

¹ Dr. Paris, *Pharmacol.* 6th edit. ii. 301.

² *Select Dissert.* p. 8, 1822; see also *Observ. on the Diseases incident to Seamen.*

³ *Memoir of the late Dr. Wright.* p. 322.

⁴ Dierbach, *Neuest. Entd. in d. Mat. Med.* 3te Abt. S. 512, 1825.

⁵ *On the Blood.*

⁶ *Arch. Gén. de Méd.* Janv. 1825, p. 141

1. **OLEUM LIMONUM**, L. E. D. [U. S.]; *Essential Oil of Lemon Peel*; *Essence of Lemons*.—This oil is usually procured by expression, as follows: the flavedo of the lemons is removed by rasping, and is afterwards expressed in hair sacks. The oil which is thus procured is received in flasks, where it deposits some of its impurities, and is then decanted and filtered.¹ Baumé² says the rasped flavedo is pressed between glass plates. Expressed oil of lemons is somewhat turbid, and liable to undergo change by keeping, owing to the mucilaginous matter which it contains in solution. Oil of lemons may be procured also by distillation; and the oil thus procured is pure, not disposed to undergo change by keeping, and is employed, under the name of *scouring drops*, for removing grease spots from silks and other textures; but its flavour is less pleasant and sweet. The greater part of the oil of commerce is brought from Portugal and Italy; some, however, is procured from France. When quite pure, it is colourless, limpid, and of a fragrant odour, like that of lemons. Its sp. gr. at 70° F. is 0.847. It is soluble in all proportions in anhydrous alcohol, and it boils at about 145° F. When the commercial oil is exposed to a temperature of —4° F. it deposits white crystals, the nature of which is not known; the rectified oil remains perfectly liquid and transparent at this temperature. Oil of lemons is composed of two isomeric oils, one (*citrene*, Dumas; *citronyle*, Blanchet and Sell) capable of forming, with hydrochloric acid, a crystalline compound (composed of $C^{10}H^8 + HCl$); the other (*citryle*) not forming any crystalline compound with this acid. The composition of the oil of lemons is $C^{10}H^8$; i. e. it is identical with that of the oil of turpentine, savin, copaiva, bergamot, and citron.³

Oil of essence of lemons possesses the stimulant properties of the milder volatile oils, and is denominated carminative and diaphoretic. In full doses, it is said to be apt to occasion headache and giddiness. Its principal use is for communicating an agreeable odour and flavour to other medicines. It may be taken as a carminative, in the dose of a few drops, on sugar (*elæosaccharum limonum*). As a perfume, it is an exceedingly useful adjunct to sulphur ointment, and to evaporating lotions. To this, as to some other volatile oils (see *oleum rosmarini*), has been ascribed the power of promoting the growth of the hair, and, in consequence, it has been added to pomatum. More recently, it has been employed as a stimulant application in various external inflammations of the eye. It was first used in these diseases by Dr. Worlitz,⁴ who applied it by squeezing the little drops of oil from the rind of the lemon into the eye. He used it with good effect in rheumatic, catarrhal, and scrofulous inflammations of the eye, in pannus and pterygium, and in opacity and some other consequences of inflammation of the cornea. It has since been tried by Mr. Foote,⁵ at the Ophthalmic Hospital, who dropped the oil into the eye in the same way that the *vinum opii* is applied. In some cases it caused excessive pain. He thinks it preferable to the *vinum opii*, in all cases where a stimulant is required.

2. **SYRUPUS LIMONUM**, L. E. [*Syrupus Limonis*, U. S.]; *Syrup of Lemons*.—(Lemon juice, strained [and freed from impurities by subsidence, E.], Oj; Sugar ℥iiss [Rectified Spirit ℥iiss, L.]. [Boil the juice for ten minutes, and strain; add the sugar to this, and dissolve. Lastly, when the syrup is cold, add the spirit.—The *Edinburgh College* dissolves the sugar in the juice, allows subsidence, skims, and pours off the clear liquor.—The *Dublin College* has now a substitute for this syrup, which is called *Syrupus Acidi Citrici*, made as follows: Citric Acid, in powder, Distilled Water, of each ℥iiss; Tincture of Lemon Peel ℥v; Simple Syrup Oijj. The acid is dissolved in the water, and the solution added to the syrup and tincture.—ED.] Refrigerant. An agreeable adjunct to diluent drinks, as barley-water, in febrile and inflammatory complaints, and to gargles.—Dose, f℥j to f℥iv.

¹ Henry and Guibourt, *Pharm. Raison*. 2ème édit. t. i. p. 284.

² *Elém. de Pharm.* t. i. p. 486.

³ For some interesting observations on this and some other oils of this order, see Soubeiran and Capitaine, *Journ. de Pharm.* xxvi. p. 1 and 66.

⁴ Dierbach, *Neuest. Endt. in d. Mat. Med.* Bd. i. S. 78, 1837; also *Lond. Med. and Phys. Journ.* for 1830, new series, vol. viii. p. 366.

⁵ *Trans. of the Med. Bot. Soc.* for 1832—3, p. 73.

320. CITRUS AURANTIUM, *Risso, L. E. D.*—THE COMMON OR SWEET ORANGE TREE.

Sex. Syst. Polyadelphia, Polyandria.

(Fructus: Fructus cortex exterior; Flores; Oleum è floribus destillatum, *L.*—Distilled water of the flowers; Volatile oil of the flowers, *E.*—Fructus succus et tunica exterior; Flores; Folia, *D.*)

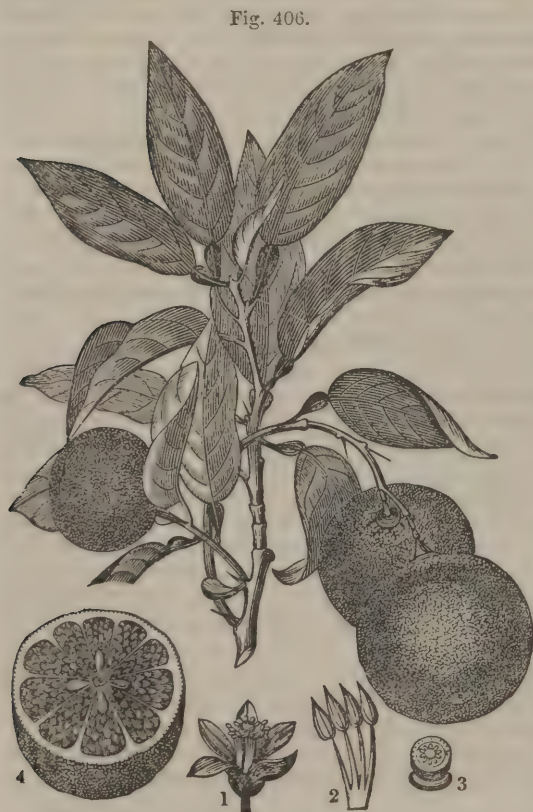
HISTORY.—It is somewhat uncertain when the sweet orange became known to Europe. The bitter orange, as well as the lemon, was known during the middle ages, but the sweet orange is supposed not to have been introduced until a period after this.¹

BOTANY.—**Gen. Char.**—See *Citrus medica*.

Sp. Char.—*Leaves* oval, elongated, acute, sometimes slightly toothed; *petiole* more or less dilated and winged. *Flowers* white, large. *Fruit* orange-coloured, roundish or ovoid, usually depressed, rarely terminated by a small knob; *rind* with convex vesicles of oil; *pulp* sweet (Wight and Arnott).—A great number of sorts is known to gardeners. The *China orange* is the common orange of the markets and of the Portuguese. The *St. Michael's orange* is a small seedless variety. The *blood-red orange* has a reddish-yellow fruit, with a pulp irregularly mottled with crimson.

Hab.—Asia; probably China. Cultivated in the South of Europe, the Azores, and the West Indies.

DESCRIPTION.—*Orange leaves* (*folia auranti*) are



Citrus Aurantium.

1. Flower. 2. A set of Stamens. 3. Section of Ovary. 4. Section of Fruit.

feebly bitter. Their watery infusion is greenish and somewhat bitter. They contain a fragrant volatile oil, which is procured by distillation, and is called, in the shops, *essence de petit grain*. *Orange flowers* (*flores aurantii seu naphæ*), when fresh, are white. They are sometimes exported from the South of Europe, stratified with common salt in barrels (*Risso*). Dried orange flowers are yellowish, and have an agreeable odour, which is less powerful than that of the fresh flowers. By distillation, orange flowers yield a fragrant volatile oil (*oleum Neroli*; *oleum aurantii*). The small green fruits (*fructus immaturus aurantii*) which fall during the great heats of the summer, are carefully collected and dried. They, as well as the unripe fruit of the next species [*Citrus vulgaris*], form the *orange berries* (*baccæ aurantii*) of the shops. Their size does not exceed that of a cherry; their colour

¹ Macfadyen, *Bot. Miscell.* i. 302.

is dark-grayish or greenish-brown; they have an aromatic odour and a bitter taste. They are used for flavouring *Curaçoa*. When smoothed by a lathe, they constitute the *issue peas* of the shops: they are preferred to ordinary peas for keeping up the discharge of an issue, on account of their pleasant odour. An infusion of orange berries is rendered green by the sesquichloride of iron. By distillation these berries yield a fragrant oil (the original *essence de petit grain*). The ripe fruit, or the orange (*aurantium*; *poma aurantiorum*), is imported in chests and boxes, each orange being separately packed in paper. The best come from the Azores and Spain; very good ones are also brought from Portugal, Italy, and other places. The rind is sometimes employed as a substitute for the rind of the bitter orange. It yields, by distillation, a fragrant volatile oil (*essential oil of sweet orange*).

COMPOSITION.—1. **Orange Flowers** were analyzed by Boullay,¹ and found to contain *volatile oil, bitter extractive, gum, acetic acid, and acetate of lime*.

2. **Orange Berries** were analyzed, in 1828, by Lebreton,² who found their constituents to be as follows: *Volatile oil, sulphur, chlorophylle, fatty matter, hesperidin, bitter astringent matter*, with some traces of *gallic acid, citric and malic acids, citrates and malates of lime and potash, gum, albumen, lignin, mineral salts*, and traces of *iron and silica*. Widemann³ obtained a *crystalline substance* analogous to, but yet different from, hesperidin.

3. **Orange Peel** has not been analyzed; but its composition is, doubtless, analogous to that of lemon peel.

4. **Orange Juice** consists of *citric acid, malic acid, mucilage, albumen, sugar, citrate of lime, and water*.

1. **VOLATILE OILS FROM THE SWEET ORANGE TREE.**—The volatile oils obtained from the leaves, flowers, and fruit rind of the sweet orange tree, agree, in their essential chemical characters, with each other, with the corresponding oils obtained from the bitter orange, and with the volatile oil of lemons. They differ principally in their odour.

The oil of sweet orange kept in the perfumers' shops, is obtained by distillation with water from the rind of the fruit.

The other volatile oils of this species are not distinguished in English commerce from those of the next species.

2. **HESPERIDIN.**

3. **BITTER PRINCIPLE** (*Aurantiin*).

4. **WIDEMANN'S CRYSTALLINE MATTER.**—Obtained from unripe oranges. It is distinguished from Hesperidin by its very distinct prismatic crystallization, by its insolubility in water, and by its not forming oxalic acid with nitric acid.

PHYSIOLOGICAL EFFECTS AND USES.—**Sweet Orange Peel** is an aromatic stimulant and tonic analogous to lemon peel, and is occasionally employed as a substitute for the *bitter orange peel*. "Large quantities of it are sometimes productive of mischief, especially in children, in whom colic, and even convulsions, are sometimes induced by it. We have known the case of a child, in which death resulted from eating the rind of an orange."⁴

Orange Juice is a refreshing and grateful beverage, and is extensively used at the table. In febrile and inflammatory complaints, it is a valuable refrigerant;—allaying thirst and diminishing preternatural heat.

321. CITRUS BIGARADIA, Risso, L. E. D.—THE BIGARADE, OR BITTER ORANGE TREE.

Sex. Syst. Polyadelphia, Polyandria.

(Fructus cortex exterior, L.—Distilled waters of the flowers; Rind of the Fruit; Volatile oil of the flowers, E. D.)

HISTORY.—The bitter orange became known to Europe during the middle ages. All the old established orange groves of Spain, as those at Seville, planted by the Moors, are of the bitter orange.⁵

¹ *Bull. de Pharm.* i. 337.

² *Ibid.* xvi. 707.

³ Macfadyen, in Hooker's *Bot. Miscell.* i. 302.

⁴ *Journ. de Pharm.* xiv. 377.

⁵ *United States Dispensatory.*

Fig. 407.

*Citrus Bigaradia.*

BOTANY. Gen. Char.—See *Citrus medica*.

Sp. Char.—*Leaves* elliptical, acute, or acuminate, slightly toothed. *Petiole* more or less winged. *Flowers* large, white. *Fruit* orange-coloured, roundish, or slightly elongated or depressed; rind with concave vesicles of oil; pulp acid and bitter (Wight and Arnott).

Numerous varieties of this are cultivated. One of these yields the fruit known in the English market as the *Seville Orange*.

Hab.—Asia. Cultivated in Europe.

DESCRIPTION.—The leaves of this species, when rubbed, emit a very agreeable odour. Distilled with water, they yield a bitter, aromatic water, known in Languedoc as *eau de naphre* (*aqua naphæ*). At the same operation is procured a volatile oil, called the *essence de*

petit grain, of finer quality than that obtained from the leaves of the sweet orange. The flowers yield by distillation with water, *orange-flower water* (*aqua aurantii*, Ph. Ed.) and *oil of Neroli* (*oleum aurantii*, Ph. Ed.) of finer quality than the corresponding preparations obtained from the flowers of the sweet orange. The unripe fruits, like those of the sweet orange, are called *orange-berries*, and are employed for the purposes before mentioned. The *Seville orange* is round and dark, and has an uneven, rugged, very bitter rind (*bitter orange peel*; *cortex aurantii*, Ph. L. and Ed.), which is employed for medical purposes as well as in the preparation of *candied orange peel*, and for flavouring the liquor called *Curaçoa*.

COMPOSITION.—The composition of the leaves, flowers, and fruit of the bitter orange is doubtless analogous to that of the corresponding parts of the sweet orange.

1. **OIL OF ORANGE-LEAF**; *Essence de petit grain*.—The term *essence de petit grain* was originally applied to the volatile oil of the orange-berry, which, however, readily underwent decomposition. It is now used to indicate the volatile oil obtained from the leaves both of the bitter and sweet orange. That procured from the bitter orange is of better quality than that from the sweet.

2. **OIL OF ORANGE-FLOWER**; *Oil of Neroli* (*Oleum Aurantii*).—Procured from the flowers of both the bitter and sweet orange; but that from the former is preferred. It is obtained by submitting the flowers, with water, to distillation; and it is found floating on the water in the receiver. It has an aromatic and fragrant odour, somewhat different from that of the flower. "It appears to me," says Soubeiran,¹ "to be a product of the alteration of the natural essential oil. The latter is more soluble than the neroli oil, and remains in solution in the water. Its presence may be demonstrated by agitating the distilled water with ether deprived of alcohol. By spontaneous evaporation, the ethereal solution leaves behind an essential oil, which has absolutely the same odour as the flowers, and which dissolves in water." Oil of neroli, furnished me by one of the most respectable importers as genuine oil, has a reddish colour. I am informed that the *essence de petit grain* is frequently substituted for it.

3. **OIL OF THE RIND OF THE BITTER ORANGE.**—This is sold by perfumers as *essential oil of bitter orange*. It has a considerable resemblance to the oil of the sweet orange.

PHYSIOLOGICAL EFFECTS AND USES.—The rind of the Seville orange being considerably more bitter than that of the sweet orange, is to be regarded as more stomachic and tonic. Its uses are the same. Its principal value is as a flavouring agent.

1. **INFUSUM AURANTII COMPOSITUM**, L. D.; *Infusum Aurantii*, D.; *Compound Infusion of Orange Peel*.—(Bitter Orange Peel, dried, ℥ss [ʒiij, D.] [Lemon Peel ʒij, L.]; Cloves, bruised, ʒj [ʒss, D.]; Boiling [distilled] Water Oj [Oss, D.]. Digest for a quarter of an hour in a vessel lightly covered, and strain [through linen or calico, E.; infuse for half an hour, D.]—An agreeable stomachic. It is

¹ *Nouv. Traité de Pharm.* i. 454.

an excellent vehicle for the exhibition of various other medicines, as saline purgatives, ammonia, bitter tinctures, &c.—Dose, fʒj to fʒij.

2. **CONFECTIO AURANTII**, L.; *Conserva Aurantii*, E. [*Confectio Aurantii Corticis*, U. S.]; *Confection of Orange Peel*.—(Orange Peel, separated by a rasp, ℥bj; Sugar ℥iij. Beat the rind in a stone mortar with a wooden pestle; then, the sugar being added, again beat them, until they are thoroughly incorporated, L.—Grate off the rind of bitter oranges, and beat it into a pulp, adding gradually thrice its weight of white sugar, E.)—An agreeable stomachic. Employed as an adjunct to bitter and purgative powders, which are to be formed into electuaries. It is a good vehicle for the exhibition of the sesquioxide of iron.

3. **SYRUPUS AURANTII**, L. E. D.; *Syrup of Orange Peel*.—(Dried Bitter Orange Peel ʒiiss; Boiling Water Oj; Pure Sugar ℥iij [Rectified Spirit ʒiiss, L.]. Macerate the peel in the water for twelve hours, in a vessel lightly covered; boil for ten minutes, strain the liquor, and proceed as for the *Syrupus Althææ*, L. [add the sugar, and dissolve with the aid of heat, E.].)—To avoid the volatilization of the essential oil, as little heat as possible should be employed in the process. The *Dublin College* orders as much sugar as may be necessary. An equally agreeable and efficacious syrup may be prepared by adding fʒj of tincture of orange peel to Oj of simple syrup. Syrup of orange peel is stomachic, but its principal use is for flavouring. Dose, fʒj to fʒij.

4. **TINCTURA AURANTII**, L. E. D.; *Tincture of Orange Peel*.—(Bitter Orange Peel, dried, ʒiiss [ʒiv D.]; Proof Spirit Oij. Macerate for seven [fourteen, D.] days [and express strongly, E.], and filter the liquor. “This tincture may be prepared by percolation, by cutting the peel into small fragments, macerating it in a little of the spirit for twelve hours, and beating the mass into a coarse pulp before putting it into the percolator,” E.) This tincture is an agreeable stomachic, and is principally employed as a flavouring adjunct to decoctions and infusions (tonic or purgative), effervescing mixtures, &c. Dose, fʒj to fʒij.

5. **AQUA FLORIS AURANTII**, L.; *Aqua Aurantii*, E.; *Orange-flower Water*.—[This preparation is now removed to the *Materia Medica* of the *London Pharmacopœia*.—Ed.] Orange-flower water is usually imported. That prepared from the flowers of the bitter orange possesses the most fragrant odour, but it is sometimes prepared from the flowers of the sweet orange. It contains free acetic acid, derived from the flowers; hence, if kept in a vessel of lead or copper, it acquires a metallic impregnation. The presence of lead in it has recently been pointed out by Mr. Squire.¹ The following are the characters of the pure orange-flower water:—

“Nearly colourless; unaffected by sulphuretted hydrogen.—*Ph. Ed.*”

Sulphuretted hydrogen produces, with either lead or copper, a dark-coloured precipitate. Orange-flower water is employed in medicine, as well as in perfumery, on account of its agreeable odour.

AQUA COLONIENSIS; *Eau de Cologne*; *Cologne Water*.—A much admired perfume. Two varieties are known in the shops—the *French* and the *German*; the latter fetches the highest price. Both profess to be made by *Farina*. The recipes for making it are numerous. I subjoin one, which is said, by Trommsdorff,² to be followed in the Cologne manufactories: Oil of Neroli; Oil of Citron; Oil of Bergamot; Oil of Orange; Oil of Rosemary: of each twelve drops; Malabar Cardamoms ʒj; Rectified Spirit Oj. Distil. Eau de Cologne forms an agreeable evaporating lotion in headache, fever, &c. It should be applied by means of a single layer of linen.

OTHER MEDICINAL AURANTIACEÆ.

The **FERONIA ELEPHANTUM**, a large tree growing in most parts of India, yields a gum which is used for medicinal purposes by the practitioners of Lower India. It is an exudation of the

¹ *Brit. Ann. of Med.* for Jan. 1837, p. 15.

² *Journ. de Pharm.* xviii. 79.

stem, and closely resembles gum Arabic.¹ It is not improbable that part of the *East India gum* brought to this country may be the produce of this tree.

ORDER LXXV. TERNSTRÖMIACEÆ, *Lindley*.—THE TEA TRIBE.

Though unable to do more than bestow a passing notice on TEA, I cannot wholly omit all reference to this important and interesting substance. Two kinds of Tea plant are cultivated in our green-houses; the one called *Thea viridis*, or *Green Tea*, the other *Thea Bohea*, or *Black*

Fig. 408.



Thea Bohea.

Tea. Great discrepancy of opinion exists as to whether the different varieties of tea of commerce are obtained from one or from two species.² The well known differences between green and black teas lend great support to the assertions of those who contend that these teas are obtained from different plants growing in different provinces of China. Mr. Reeves's observations on this point³ appear to me exceedingly apposite. In commerce, two principal kinds of tea are distinguished—the *Black* and *Green*; to the first belong *Bohea*, *Congou*, *Campoi*, *Souchong*, *Caper*, and *Pekoe*; to the latter, *Twankay*, *Hyson-skin*, *Hyson*, *Imperial*, and *Gunpowder*.⁴ Frank⁵ analyzed both black and green teas, and obtained the following results:—

	<i>Black.</i>	<i>Green.</i>
Tannin	40.6	34.6
Gum	6.3	5.9
Woody fibre	44.8	51.3
Glutinous matter	6.3	5.7
Volatile matter, and loss	2.0	2.5
Tea	100.0	100.0

Sir H. Davy⁶ also found more tannin in black than in green tea, in the proportion of 48 to 41. But these results are opposed to our daily experience, as derived from flavour, which indicates

¹ Ainslie, *Mat. Ind.* i. 161.

² See Royle, *op. cit.*

³ For some interesting observations on *Assam Tea*, see Royle's *Essay on the Productive Resources of India*, Lond. 1840; and Bruce's *Report on the Manufacture of Tea, and on the Extent and Produce of the Tea Plantations in Assam*, in Jameson's *Journal*, xxviii. 126, 1840.

⁴ Gmelin, *Handb. d. Chem.* li. 1252.

⁵ See Royle's *Illustr.* p. 109; and Hooker, *Bot. Mag.* t. 3148.

⁶ *Phil. Trans.* for 1803, p. 268.

the greater astringency in the green tea, and to the experiments of Mr. Brande.¹ The difference in the quantity of tannin in the two kinds of tea is, however, not very great. A few years ago, Oudry² announced the existence in tea of a crystalline, salifiable base, to which he gave the name of *theina*; but more recently Jobst³ has asserted its identity with *caffein*, already noticed. Dr. R. D. Thomson⁴ has described a fixed oil (*Tea Oil*) obtained from the tea plant. It is composed of *elaine* 75, and *stearine* 25. Notwithstanding the extensive employment of tea as an article of diet, yet it is no easy matter to ascertain correctly its precise effects on the constitution. Its astringency is proved by its chemical properties; and hence tea may be resorted to as an easily accessible antidote in cases of poisoning by substances containing vegetable alkalis, or by emetic tartar. Another quality possessed, especially by green tea, is that of diminishing the tendency to sleep. Hence, like coffee, it is often resorted to by those who desire nocturnal study. Moreover, it may be employed as an antisporific to counteract the effects of opium and intoxicating liquors; and Dr. Clutterbuck⁵ has suggested its application to the relief of the stupor of fever, which he considers to be nearly allied to intoxication. Tea appears to possess a sedative influence with regard to the vascular system; and in this, as well as in the watchfulness which it produces, tea somewhat resembles foxglove. On account of its sedative power, Dr. T. Percival⁶ recommends its use in feverish and inflammatory diseases, and I can speak, from frequent observation, of its good effects in these maladies. To this power should also be referred the relief of headache experienced by the use of tea. In colds, catarrhs, rheumatism, &c. warm infusion of tea is frequently employed as a diluent, diaphoretic, and diuretic. Strong green tea, taken in large quantities, is capable, in some constitutions, of producing most distressing feelings,⁷ and of operating as a narcotic. Dr. Lettsom⁸ found that a strong infusion of tea, introduced into the abdomen of a frog, caused paralysis of the hind extremities of the animal.⁹

ORDER LXXVI. DIPTERACEÆ, Lindley.—THE DIPTEROCARPUS TRIBE.

DIPTEROCARPEÆ, Blume.

DYOBALANOPS AROMATICA, Gaertner (*D. Camphora*, Colebrooke; *Shorea camphorifera*, Roxb.) is a large tree growing in Sumatra and Borneo. From its stem are obtained a liquid called *Camphor oil*, and a crystalline solid denominated *Sumatra* or *Borneo Camphor*.

1. *Liquid Camphor*; *Camphor Oil*.—Is obtained by making deep incisions into the tree with an axe. The oil gushes out, and is received in bamboos or other convenient utensils.¹⁰ It is occasionally imported into this country in tin canisters. It is sometimes perfectly limpid, transparent, and colourless; but more usually it is more or less coloured, being yellow or brownish. Its odour is somewhat analogous to that of oil of cajuputi, combined with the odour of camphor and cardamoms. Some samples have a strong odour of turpentine. This oil has been analyzed by Martius.¹¹ The mean of three analyses gave him for its constituents carbon, 83.129, hydrogen 11.346, and oxygen 5.25; or $C^{20}H^{16}O^4$.¹² Recently, Pelouze¹² has analyzed it. He regards it as a hydrocarbon, whose formula is $C^{20}H^{16}$. By exposure to the air, it rapidly oxidizes and becomes $C^{20}H^{16}O^4$. Hence, therefore, it would appear that Martius must have analyzed an oxidized oil. Camphor oil has been employed in the preparation of scented soap. Sixty pounds of dark brown oil yielded forty pounds of colourless liquid oil, and twenty pounds of crystalline camphor.

2. *Sumatra* or *Borneo Camphor*. By the natives of Sumatra it is termed *Kapûrbarus* (i. e. *Barous Camphor*).—It is found in the natural fissures or crevices of the wood, and is obtained by cutting down the tree, dividing it transversely into several blocks, which are split with wedges into small pieces, from the interstices of which the camphor, if there be any, is extracted.¹³ After being separated from impurities, it is packed in *catties*. Being much esteemed by the Chinese, it fetches a very high price. According to Mr. Crawford,¹⁴ its value is 78 times that of Japan camphor! It rarely comes to this country as a commercial article. For some of the samples in my museum I am indebted to the late Mr. Gibson (of the firm of Howard, Jewell, and Gibson, of Stratford), who stated that "they are part of two very small boxes imported about twenty years ago, which were bought by me at the common price of camphor at the time, but which it was afterwards discovered were invoiced at an enormous price. Our firm gave

¹ *Quart. Journ.* xii. 201.

² *Ann. d. Pharm.* xxv. 63, 1838.

³ *Inquiry into the Seat and Nature of Fever*, 2d edit. p. 434.

⁴ Dr. R. Percival, *Dublin Hosp. Rep.* i. 219.

⁵ For some interesting information on Tea, see Dr. Sigmond's work, entitled *Tea, its Effects, Medicinal and Moral*, 1839.

⁶ Prince, Roxb. *Fl. Ind.* ii. 618.

⁷ *Journ. de Pharm.* xxvi. 646.

⁸ *History of the Indian Archipelago*, iii. 418.

⁹ Thomson, *Org. Chem.* p. 295.

¹⁰ Jameson's *Journal*, xxii. 350.

¹¹ *Essays*, vol. i.

¹² *Natural History of the Tea Tree*, 1772.

¹³ *Berlin. Jahrbuch*, xl. 464, 1838.

¹⁴ Marsden, *History of Sumatra*, 3d edit. p. 150.

them up to the importers, reserving samples, and they were re-shipped for India. I never on any other occasion except one saw a small specimen of what I have named *native camphor*."

Sumatra or Borneo camphor occurs in small white fragments of crystals. They are transparent, brittle, and have a camphoraceous odour and a hot taste. According to Pelouze, its crystalline form is a prism with six regular faces, and derived from the rhombohedric system. It is lighter than water, very slightly soluble only in water; but is very soluble in alcohol and ether. It is fusible and volatile. Its composition, according to Pelouze, is $C^{20}H^{18}O^2$.

Sumatra Camphor is distinguished from Common or Laurel Camphor by several characters; such as the form of the crystals above mentioned; their greater hardness, so that when shaken in a bottle they produce a ringing sound; they are more brittle, and do not so readily sublime and condense in crystals in the upper parts of the bottle.

Its medicinal properties are probably similar to those of ordinary or laurel camphor. But in the East, especially by the Chinese, the most extravagant virtues are assigned to it, and it is accordingly highly valued. In the *Puntsauu* it is called Lung Naou Heang, or "Dragon's Brain Perfume."

ORDER LXXVII. BYTTNERIACEÆ, *De Candolle*.—THE CACAO TRIBE.

Fig. 409.



Theobroma Cacao.

The *THEOBROMA CACAO* is a native of the West Indies and of Continental America.

Its seeds (*nuclei cacao*) when torrefied, and with various additions (sugar, and usually either cinnamon or vanilla), made into a paste, constitutes *chocolate* (*chocolata*), which furnishes a very nourishing beverage, devoid of the ill properties possessed by both tea and coffee, but which, on account of the contained oil, is apt to disagree with dyspeptics.¹ *Coroa* is another preparation of these seeds. It is said to be made from the fragments of the seed-coats mixed with portions of the kernels. It is somewhat astringent, and is adapted for persons with relaxed bowels.

ORDER LXXVIII. MALVACEÆ, *R. Brown*.—THE MALLOW TRIBE.

CHARACTERS.—*Calyx* of 5 (rarely 3 or 4) sepals, more or less coherent at the base, valvate in æstivation, often with bracts or external sepals forming an involucre or outer calyx. *Petals* as many as the sepals, and alternate with them; hypogynous, equal; spirally contorted in æstivation, generally adnate to (but sometimes distinct from) the lower part of the tube of the stamens. *Stamens* equal in number, or more commonly a multiple of the petals; generally indefinite (rarely definite), hypogynous. *Filaments* united into a tube, and unequal in length, the outer ones being shorter. *Anthers* 1-celled, uniform, dehiscing by a transverse chink. *Ovary* of many carpels, generally verticillated round the axis, and coherent (sometimes free). *Styles* as many as the carpels, either distinct or united. *Stigmas* as many as the carpels, more or less distinct. *Carpels* either 1- or 2-seeded, and dehiscing inward by a chink, or polyspermous, with a loculicidal dehiscence, or having a septum in the middle which bears the seed on the inner side; in some cases nearly free, in others united into a many-celled capsule or an anomalous berry. *Albumen* none. *Embryo* straight. *Radicle* terete. *Cotyledons* twisted like a chrysalis.—*Herbs, shrubs, or trees.* *Leaves* alternate, generally petiolate, and with stipules. (*De Cand.*)

PROPERTIES.—"The uniform character is to abound in mucilage, and to be totally destitute of all unwholesome qualities" (Lindley).

¹ For particulars respecting the manufacture of chocolate, see Ure, *Dictionary of Arts*, p. 292; and Soubeiran, *Traité de Pharm.* i. 447.

322. *MALVA SYLVESTRIS*, Linn. E.—COMMON MALLOW.

Sez. Syst. Monadelphia, Polyandria.
(Herb, E.)

HISTORY.—According to Dr. Sibthorp,¹ the Μαλάχη χερσαία of Dioscorides² is the *Malva sylvestris*.

BOTANY. *Gen. Char.*—*Calyx* 5-cleft, persistent, surrounded by an involucl of usually 3, rarely 1 or 2, or 5 or 6, more or less oblong or setaceous bracteoles. *Ovary* with many cells, each with 1 ovule. *Styles* as many as the cells. *Carpels* several (rarely only 5), capsular, indehiscent, 1-seeded, circularly arranged around the axis. *Radicle* inferior (Wight and Arnott).

Sp. Char.—*Stem* erect. *Leaves* 5- to 7-lobed, acute. *Pedicels* and *petioles* hairy. (De Cand.)

Root perennial, tapering, branching, whitish. *Stem* 2 or 3 feet or more high, branched. *Leaves* deep green, soft and downy. *Flowers* large, three or four together, axillary. *Petals* obcordate, purplish rose-coloured, with deeper veins, combined by the base of their claws.

Hab.—Indigenous; hedges and road sides. Flowers from June to August.

DESCRIPTION.—Common Mallow (*herba malvæ sylvestris*) is odourless, and has merely a mucilaginous herbaceous taste. Its watery infusion is deepened in colour by the sesquichloride of iron, and forms a precipitate with acetate of lead. Dwarf mallow (*herba malvæ rotundifoliæ*) possesses similar properties.

COMPOSITION.—I am unacquainted with any analysis of this plant. The constituents are probably similar to those of *Althæa officinalis*. *Mucilage* is the prevailing principle. *Extractive* also is another constituent. The *colouring matter* of the flower is an exceedingly delicate test of alkalies, which render it green.

PHYSIOLOGICAL EFFECTS AND USES.—Emollient and demulcent. Employed in the form of decoction, in irritation of the alimentary canal, and of the pulmonary and urinary organs. In tenesmus, the decoction is used in the form of enema. In external inflammations, emollient fomentations and cataplasms of mallow are sometimes employed.

323. *ALTHÆA OFFICINALIS*, Linn. L. E.—COMMON MARSH-MALLOW.

Sez. Syst. Monadelphia, Polyandria.
(Folia; Radix, L.—Leaves; Root, E.)

HISTORY.—According to Dr. Sibthorp,³ this plant is the Ἀλθαία of Dioscorides.⁴

BOTANY. *Gen. Char.*—*Calyx* surrounded by 6- to 9-cleft, involucl. *Carpels* numerous, capsular, closely and circularly arranged round the axis (Wight and Arnott).

Sp. Char.—*Leaves* softly tomentose on both sides, cordate or ovate, toothed, undivided, or somewhat 3-lobed. *Peduncles* axillary, many-flowered, much shorter than the leaf. (De Cand.)

Root perennial, tap-shaped, rather woody. *Stem* 2 or 3 feet high. *Leaves* hoary green, peculiarly soft and downy, with a fine starry pubescence. *Flowers* 3 or 4 together, on axillary stalks, large, pale rose-coloured.

Hab.—Indigenous; marshes, especially near the sea.

DESCRIPTION.—The leaves of Marsh-mallow (*foliæ althææ*) are odourless, and have a mucilaginous taste. The root (*radix althææ*) is long, cylindrical, branched, about the thickness of the finger, plump, mucilaginous, white internally, and covered with a yellowish epidermis. That which is imported from France has been deprived

¹ *Prodr. Fl. Græc.* ii. 45.

² *Prodr. Fl. Græc.* ii. 42.

³ *Lib.* ii. cap. 144.

⁴ *Lib.* iii. cap. 163.

of its epidermis, and is white (*decorticated root of marsh-mallow*). Its odour is feeble; its taste sweet and mucilaginous. Iodine colours it dark blue. Sesquichloride of iron forms with the concentrated decoction, a brown semi-transparent gelatinous mass.

COMPOSITION.—Marsh-mallow root has been analyzed by Bacon,¹ by L. Meyer,² by Wittstock,³ and by Buchner.⁴ The results of the latter chemist are as follows:—*Fatty oil* 1.26, *glutinous matter* 1.81, *uncrystallizable sugar* and *althein* 8.29, *mucilage* 35.64, *starch* 37.51, *phosphate of lime* 8.29, *vegetable medulla* 11.05, and *woody fibre* 7.50 [excess 11.35].

ASPARAGIN; Asparamide; Althein.—The substance which has been called *althein* is identical with *asparagin*. It is crystallizable, odourless, and almost tasteless. It is soluble in water and alcohol, sp. gr. 0.837; but it is insoluble in absolute alcohol and in ether. It consists of $C^8H^7N^2O^5$. Acted on by the watery solutions of the alkalies, it evolves ammonia, and is converted into *aspartic acid* ($C^8H^5NO^6$); hence it is called *asparamide*, as it is an aspartite of ammonia ($C^8H^5NO^6 + H^3N$), minus an atom of water. It has an influence on the therapeutic properties of the root.

PHYSIOLOGICAL EFFECTS AND USES.—Similar to those of common mallow, already stated. On the continent it is a favourite demulcent. The *pastilles* and *pâte de guimauve* are used as pectorals. The powder of marshmallow root is used in France to envelop pills. "The simple decoction is recommended as an injection, to be thrown into the vagina, in cases of difficult labour, arising from rigidity of the soft parts."⁵

1. **MISTURA ALTHÆÆ, E.; Marsh-mallow Mixture.**—(Root of *Althæa* ʒiv; Raisins, stoned, ʒij; Boiling Water Ov. Boil down to three pints; strain through linen or calico, and, when the sediment has subsided, pour off the clear liquor for use.)—An agreeable diluent and demulcent. Employed in visceral inflammation and irritation; as nephritis, calculous affections, gonorrhœa, strangury, &c. From one to three pints may be taken in the course of the day.

2. **SYRUPUS ALTHÆÆ, L. E.; Syrup of Marsh-mallows.**—(*Althæa* Root, sliced, ʒiiss; Pure Sugar lbiss; Water [boiling, *E.*] Boil down the water with the root to one-half [strain, *E.*], and express [strongly through calico, *E.*] the liquor when cold, *L.* Set aside for twenty-four hours, that the impurities may subside; then pour off the liquor, and the sugar being added, boil down to a proper consistence.)—Demulcent, employed as an adjunct to cough mixtures, and as a pectoral for children. It readily ferments, and becomes ropy.—Dose, f ʒj to f ʒss.

324. GOSSYPIUM HERBACEUM, Linn. E.—COMMON COTTON.

Sex. Syst. Monadelphia, Polyandria.
(Hairs attached to the seed, *E.*)

HISTORY.—It is somewhat doubtful who first mentioned cotton. There is some reason for supposing that cotton cloth is referred to in the Old Testament.⁶ Cotton (βύσσος), is mentioned by Herodotus;⁷ but he or his translators are in error, in stating⁸ that the Egyptians, in embalming, wrapped the body in cotton cloth; since all mummy cloths are found, on a microscopic examination, to be linen.⁹ Pliny¹⁰ speaks of the cotton plant (*Gossypion*) and of the cloth (*Xylina*) made of the woolly substance which envelops the seeds.¹¹

BOTANY. Gen. Char.—*Calyx* cup-shaped, obtusely 5-toothed, surrounded by a

¹ *Journ. de Chim. Méd.* ii. 551.

² *Pharm. Central-Blatt für* 1831, S. 277.

³ Montgomery, *Obs. on the Duob. Pharm.*

⁴ Harris, *Natural History of the Bible*; Carpenter, *Scripture Natural History*.

⁵ *Thalia*, cv.

⁶ Dintochet, in Jameson's *Journal*, vol. xxiii. p. 320. This author suggests that the βύσσος of Herodotus was the filamentous weavable matter which lint [flax] supplied.

⁷ *Hist. Nat. lib. xix. cap. 2, ed. Valp.*

⁸ *Euterpe*, lxxxvi.

⁹ For farther historical details, see Royle's *Illustr.* p. 84, et seq.

² Gmelin, *Handb. d. Chem.* ii. 1251.

⁴ *Ibid.* für 1832, S. 511.

3-leaved involucrel, with the leaves united and cordate at the base, and deeply cut or toothed irregularly. *Style* simple, marked with 3 or 5 furrows towards the apex. *Stigmas* usually 3, sometimes 5. *Capsules* 3- to 5-celled, 3- to 5-valved at the apex, loculicidal. *Seeds* numerous, imbedded in cotton. Young branches and leaves more or less conspicuously covered with little black dots; nerves below usually with one or more glands (Wight and Arnott).

Sp. Char.—Bi-triennial; *young parts* hairy. *Leaves* hoary, palmate, with sub-lanceolate, rather acute lobes. *Stipules* falcate-lanceolate. *Leaves* of the exterior calyx dentate. *Capsules* ovate pointed. *Seeds* free, clothed with firmly adhering white down under the long white wool (Roxburgh).—*Petals* of a lively yellow colour, with a purple spot near the claw. Dr. Roxburgh¹ particularly distinguishes three varieties cultivated in India—viz., the *Dacca*, the *Berar*, and the *China* cottons.

Hab.—Asia. Cultivated in India, Syria, Asia Minor, the Mediterranean, and America.

DESCRIPTION.—The filamentous substance, called *cotton* (*gossypium*), consists of tubular hairs, which arise from the surface of the seed-coat. By drying, they become flattened; and in this state, if they be immersed in water and examined by the microscope, they appear like distinct, flat, narrow ribands, with only occasional appearances of joints, which are indicated by a line at a right angle, or nearly so, to the side of the tube. Cotton is distinguished (under the microscope) from the vegetable fibre which constitutes linen by the tubes of the latter being in bundles, round, tapering at the extremities, and, when jointed, having oblique articulations. Cotton which has undergone no preparation is denominated *raw cotton*.²

COMPOSITION.—Cotton is a modification of *lignin*, and consists, therefore, of *carbon*, *hydrogen*, and *oxygen*; but the precise relative proportions of its constituents have not been ascertained. In all its essential chemical properties it agrees with ordinary woody fibre. It is completely insoluble in water, alcohol, ether, oils, and vegetable acids. Strong alkaline lyes dissolve it. The strong mineral acids decompose it. With nitric acid it yields oxalic acid.

PHYSIOLOGICAL EFFECTS AND USES.—Raw cotton, or cotton wool, has been employed with apparently good effect in the treatment of burns.³ It allays pain and irritation, apparently by forming, with the discharges, a substitute for the epidermis, under the protection of which the process for the formation of the new cuticle takes place, undisturbed by external irritation. The exclusion of the air seems to be a most important part of the treatment; and, of course, to effect this, many other agents (as lint) will answer in the place of cotton. The following is the method of employing cotton: The cotton should be carded in narrow fleeces, thin enough to be translucent, and applied in successive layers, so as completely to protect the injured parts from the effects of motion and pressure. When the skin is severely scorched, a spirituous or turpentine wash may be applied previously to the application of the cotton. As complete repose of the part is necessary, the first dressing should be allowed to remain as long as possible undisturbed. Raw cotton has also been used as a topical application in erysipelas.⁴

Cotton-wool, impregnated with nitre or chlorate of potash, has been employed as *moxa*.

The well-known superiority of linen to cotton, as a dressing for wounds and ulcers, is usually ascribed to the triangular shape of the cotton fibres, the sharp

Fig. 410.

*Gossypium herbaceum*.

¹ *Fl. Ind.* iii. 184.

² For much interesting information regarding Cotton, but which is unsuited to this work, consult Royle, *op. cit.*; McCulloch, *Dictionary of Commerce*; and Ure, *Dictionary of Arts*.

³ Anderson, *Edinb. Med. and Surg. Journ.* xiii. 215, 1828.

⁴ *Lond. Med. Gaz.* Nov. 8, 1839.

angles of which are supposed to cut and irritate the flesh. But this shape of the fibres exists only in the imagination of those who have never examined them by the microscope. Raspail¹ ascribes the superiority of linen for surgical purposes to the hollow condition of the tubular fibrillæ, by which they are enabled to absorb into their interior the blood or purulent secretion. The tubes of cotton, on the other hand, are filled with an organizing substance, and, therefore, can imbibe nothing into their interior.

[**COLLODIUM**, U. S.; *Collodion*.—(Take of Cotton, freed from impurities, and finely carded, half an ounce; Nitrate of Potassa, in powder, ten ounces; Sulphuric Acid eight fluidounces and a half; Ether two pints and a half; Alcohol a fluidounce. Add the Sulphuric Acid to the Nitrate of Potassa in a Wedgewood mortar, and triturate them until uniformly mixed; then add the Cotton, and by means of the pestle and a glass rod, imbue it thoroughly with the mixture for four minutes. Transfer the Cotton to a vessel containing water, and wash it, in successive portions, by agitation and pressure, until the washings cease to have an acid taste, or to be precipitated on the addition of chloride of barium. Having separated the fibres by picking, dry the cotton with a gentle heat, dissolve it by agitation in the Ether, previously mixed with the Alcohol, and strain. Collodion should be kept in closely-stopped bottles previously well dried. The first part of the above process produces gun-cotton, which is dissolved in ether. It is a transparent solution, of syrupy consistence and ethereal smell. It is used as an application in surgery to wounds, with the view of producing cohesion of the edges. When applied, the ether evaporates, leaving a film, which is the bond of union. It is sometimes used as a covering to ulcers, burns, and superficial inflammation, as a protection and stimulant. I have used it with advantage in sore nipples.]

ORDER LXXIX. LINACEÆ, *Lindley*.—THE FLAX TRIBE.

LINÆE, *De Candolle*.

CHARACTERS.—*Calyx* 3- or 4, generally 5-sepaled. *Sepals* coherent only at the base, imbricate in æstivation, continuous with the peduncle, and therefore persistent. *Petals* as many as the sepals; hypogynous, unguiculate at the base, slightly united together, and to the ring of the stamens; alternate with the sepals, twisted in æstivation. *Stamens* equal in number, and alternate with the petals, cohering into a monadelphous ring at the base, and having an abortive filament, or tooth, between each. *Anthers* innate, bilocular, bi-rimose. *Ovaries* subglobose, with as many cells as there are sepals, rarely fewer. *Styles* as numerous as the cells of the ovary. *Capsule* globose, crowned by the permanent bases of the styles, composed of carpels having induplicate margins and dehiscing at the apex by two valves, and which are divided into partial cells, by an incomplete dissepiment arising from the centre. Seeds in each cell two inverted. *Albumen* generally none, but in its stead there is a tumid, fleshy endopleura. *Embryo* straight, with the radicle turned towards the hilum.—*Herbs or shrubs*, with entire exstipulate leaves. (De Cand.)

PROPERTIES.—The fibres of Linaceæ have great tenacity. The seeds abound in oil and mucilage, and are in consequence emollient.

325. LINUM USITATISSIMUM, *Linn. L. E. D.*—COMMON FLAX.

Sex. Syst. Pentandria, Pentagynia.

(Semina; Oleum e seminibus expressum, *L. D.*—Seeds; Meal of the seeds deprived of their fixed oil by expression; Expressed oil of the seeds, *E.*)

HISTORY.—From time immemorial flax has been employed in the manufacture of cloth; and it appears, from our most ancient records, that Egypt was celebrated for its production.² Dutrochet³ asserts that mummy cloth is made of flax.

¹ *Chim. Organ.*

² *Jameson's Journal*, xxii. 221.

³ *Exodus*, ix. 31; *Herodotus*, *Euterpe*, cv.

BOTANY. Gen. Char.—*Sepals* 5, distinct, quite entire or serrated. *Petals* 5. *Stamens* 5. *Styles* 3 to 5, distinct from the base, or combined to the middle or apex (Wight and Arnott).

Sp. Char.—Smooth, erect. *Leaves* lanceolate or linear. *Panicle* corymbose. *Sepals* ovate, acute, with membranous margins. *Petals* somewhat crenate, larger by three times than the calyx. (De Cand.)—Annual. One or two feet high. *Leaves* distant. *Flowers* large, purplish-blue. *Capsule* globular, about the size of a small pea.

Hab.—Indigenous; cornfields; not unfrequent. Extensively cultivated in this, as well as in other European countries, both for its fibre for making thread, and for its oil obtained from the seeds.

DESCRIPTION.—The seed of the flax, commonly termed *linseed* or *lintseed* (*semina lini*), is small (about a line long), oval, oblong, flattened on the sides with acute edges, pointed at one extremity, smooth, glossy, brown externally, yellowish-white internally, odourless, and has an oily mucilaginous taste. The seed-coat is mucilaginous; the nucleus oily. The *cake* (*placentula lini*) left after the expression of the oil, is usually denominated *oil cake*; it forms, when ground to a fine powder, *linseed meal* (*farina lini*). The best oil cake for the preparation of linseed meal is the English, fresh made. Foreign cake is of inferior quality. The colour of linseed meal is grayish-brown. It abounds in mucilage. The meal prepared by grinding the unpressed seeds yields a considerable quantity of oil.

The substance termed *flax* is prepared from the fibrous portions of the bark of the plant.¹ The short fibres which are removed in heckling constitute *tow* (*stupa*), which is employed both in pharmacy and surgery. Of flax is made *linen* (*linteum*), which, when scraped, constitutes *lint* (*linteum carptum*; *linamentum*), an important agent to the surgeon.²

COMPOSITION.—Linseed has been analyzed by L. Meyer.³ Its constituents he found to be as follows: *Fat oil* (in the nucleus) 11.265, *wax* (in the husk principally) 0.146, *acrid soft resin* (in the husk principally) 2.488, *resinous colouring matter* 0.550, *yellow extractive with tannin and salts* (nitre and the chlorides of potassium and calcium) 1.917, *sweet extractive, with malic acid and some salts*, 10.884, *gum* (in the nucleus) 6.154, *nitrogenous mucilage, with acetic acid and salts* (in the husk principally), 15.120, *starch, with salts* (in the husk), 1.480, *albumen* (in the nucleus) 2.782, *gluten* (in the nucleus) 2.932, *husk and emulsion* (?) 44.382. The ashes contained *oxide of copper*.

1. **FIXED OIL.**—(See p. 989.)

2. **MUCILAGE OF LINSEED.**—Has been examined by Bostock,⁴ by Vauquelin,⁵ and by Guerin-Varry.⁶ Resides in the seed coats. Is extracted by hot water. When the solution is mixed with alcohol, white mucilaginous flocks are precipitated. Diacetate of lead forms a precipitate in it. Neither infusion of nutgalls nor chlorine have any effect on it. It is not coloured blue by iodine. It reddens litmus (owing to the free acetic acid). It consists of two parts: one soluble, the other insoluble in water. Its ashes contain carbonates of potash and lime, phosphate of lime, chloride of potassium, sulphate of potash, oxide of iron, alumina, and silica.



Linum usitatissimum.

Proximate Analysis.		Ultimate Analysis.	
Soluble part	52.70	Carbon	34.30
Insoluble part	29.69	Hydrogen	5.69
Ashes	7.11	Nitrogen	7.27
Water	10.30	Oxygen	52.74
Mucilage of Linseed		Mucilage of Linseed	
100.00		100.00	

¹ See Ure's *Dictionary of Arts*, p. 482.

² [A microscopical examination shows that much of the *Lint* now sold consists of scraped cotton.—Ed.]

³ Gmelin, *Handb. d. Chem.* ii. 1251.

⁴ *Ann. de Chim.* lxxx. 314.

⁵ *Nicholson's Journal*, xviii. 31.

⁶ *Journ. de Chim. Méd.* vii. 7.9.

a. Soluble part (*Arabine?*) soluble in cold water. Treated with nitric acid, yields 14.25 per cent. of mucic acid, besides some oxalic acid.

β. Insoluble part. A nitrogenous substance, not soluble in water, and not yielding mucic acid by the action of nitric acid. Properly speaking, therefore, it is not a gummy substance.

PHYSIOLOGICAL EFFECTS.—Linseed is emollient and demulcent. It also possesses nutritive qualities; for, in the form of a thick mucilage (or jelly, as it is termed), it is employed for fattening cattle. *Linseed cake* is also employed for a similar purpose. *Linseed oil* is a mild laxative.

USES.—Employed, to allay irritation, in the form of *infusion* or *tea*, *expressed oil*, and *meal*.

1. **INFUSUM LINI COMPOSITUM**, L. [U. S.]; *Infusum Lini*, E.; *Linseed Tea*.—(Linseed, bruised, ʒvj [ʒss, U. S.]; Liquorice Root, bruised, ʒij; Boiling [distilled, L.] Water Oj. Digest near the fire, in a lightly covered vessel, and strain [through linen or calico, E.].)—Employed as an emollient and demulcent in irritation and inflammation of the pulmonary and urinary organs, and of the mucous membranes generally: as gonorrhœa, dysentery, alvine irritation, and pulmonary affections. It is rendered more palatable by the addition of sliced lemon and sugar-candy.—Dose, fʒij to fʒiv, or *ad libitum*.

[2. **DECOCTUM LINI COMPOSITUM**, D.; *Compound Decoction of Linseed*.—(Take of Linseed ʒj; Liquorice Root, bruised, ʒss; Water Oiss. Boil for ten minutes in a covered vessel, and strain while hot.)—ED.]

3. **OLEUM LINI**, L. E. D. [U. S.]; *Linseed Oil*.—To prepare this oil, the seeds are first bruised or crushed, then ground, and afterwards subjected to pressure in the hydraulic or screw press.¹ *Cold-drawn linseed oil* (*oleum lini sine igne*) is paler coloured, less odorous, and has less taste, than linseed oil prepared by the aid of a steam heat of about 200° F. (*oleum lini*, offic.); but, according to Mr. Brande,² it “soon becomes rancid and more disagreeable than that expressed at a higher temperature.” The seeds yield by cold expression 18 or 20 per cent. of oil; but by the aid of heat from 22 to 27 per cent. Linseed oil is usually amber-coloured; but it may be rendered quite colourless. For a fine sample of colourless oil I am indebted to Mr. Whipple. Linseed oil has a peculiar odour and taste; it is soluble in alcohol, but more readily so in ether. When exposed to the air, it dries into a hard transparent varnish. This change is greatly accelerated by boiling the oil, either alone or with litharge, with sugar of lead or with common white vitriol. The resulting oil is called *drying oil* or *boiled oil*. The efficacy of the process is ascribed by Liebig³ to the elimination of substances which oppose the oxidation of the oil. The ultimate composition of linseed oil, according to Saussure, is carbon 76.014, hydrogen 11.351, and oxygen 12.635. Its proximate constituents are *oleic acid* (chiefly), *margaric acid*, and *glycerin*.—Rarely employed internally. Its most ordinary use is for the preparation of *Linimentum calcis*, already (Vol. I. p. 564) described.⁴

4. **FARINA LINI**, E.; *Linseed Meal*.—(The meal of the seeds deprived of their fixed oil by expression, E.)—Emollient. Employed in the preparation of the *linseed meal poultice*. It is a constituent of the *pulvis pro cataplasmate*, D., already noticed. The farina of the unpressed linseed is preferred to the powder of linseed cake, on account of its oleaginous quality. What is usually sold as such has been prepared from recently pressed English oil cake.

5. **CATAPLASMA LINI**, L.; *Linseed Meal Poultice*.—(Boiling Water ʒx; Linseed, powdered, ʒivss, or as much as may be sufficient. Add the water by de-

¹ See Ure's *Dictionary of Arts*, p. 699.

² *Journ. de Pharm.* xxvi. 193.

² *Dict. of Pharm.*

⁴ [Since the publication of the first volume of this work, the *Linimentum Calcis* has been introduced into the London Pharmacopœia: Take of Solution of Lime and Olive Oil, each ten fluidounces; shake them together. The Dublin College orders of Lime Water and Olive Oil, each two fluidounces.—ED.]

greens to the linseed, stirring constantly that a poultice be made.)—A valuable emollient poultice.

326. LINUM CATHARTICUM, Linn. E.—PURGING FLAX.

Sex. Syst. Pentandria, Pentagynia.
(Herb, E.)

HISTORY.—First mentioned by Thalius in the sixteenth century.¹

BOTANY. Gen. Char.—See *Linum usitatissimum*.

Sp. Char.—Smooth, erect. *Leaves* opposite, obovate-lanceolate. *Stem* above dichotomous. (De Cand.)

Annual. *Stem* slender, 2 to 6 inches high. *Flowers* drooping before expansion, white, small.

Hab.—Indigenous; pastures; common.

DESCRIPTION.—Purging flax (*herba lini cathartici*) is odourless, but has a very bitter taste.

COMPOSITION.—I am unacquainted with any analysis of this plant. Probably its purgative principle is *bitter extractive*.

PHYSIOLOGICAL EFFECTS AND USES.—Cathartic and occasionally diuretic; but somewhat uncertain in its operation. Formerly used in rheumatism. Now almost obsolete. Dose ʒj of the dried plant; or an infusion of a handful of the fresh plant may be employed.

ORDER LXXX. CARYOPHYLLACEÆ.—THE CHICK-WEED TRIBE.

CARYOPHYLLÆ, Jussieu; De Candolle.

CHARACTERS.—*Calyx* generally persistent, of 4, or oftener 5 sepals, which are continuous with the pedicel, and either free or coherent into a 4- or 5-dentate tube, imbricate in æstivation. *Petals* as many as the sepals (very rarely 0), inserted on the torus, which is more or less elevated on a pedicel (anthophorus), alternate with the sepals, unguiculate, having the fauces sometimes crowned with petaloid scales. *Stamens* as many as, or double the number of, the petals inserted in the torus. *Filaments* subulate, sometimes submonadelphous at the base. *Anthers* 2-celled. *Ovary* simple, 2- to 5-valved, inserted at the apex of the torus, and crowned by an equal number of styles. *Capsule* of 2 to 5 valves, united at the base, dehiscing at the apex, generally 1-celled, sometimes 2- to 5-celled. *Septa* protruding from the middle of the valves, incomplete or continuous to the axis. *Placenta* central. *Seeds* numerous (very seldom few or definite); *albumen* farinaceous generally central; *embryo* usually peripheral, more or less incurved (seldom central and straight); *radicle* directed towards the hilum. *Herbs* or *undershrubs*, with opposite entire leaves. *Stems* jointed. (De Cand.)

PROPERTIES.—Remarkable, for the most part, for their insipidity and consequent inactivity.

327. DIANTHUS CARYOPHYLLUS, Linn.—CLOVE PINK; CARNATION, OR CLOVE GILLYFLOWER.

Sex. Syst. Decandria, Digynia.
(Flores.)

HISTORY.—First noticed by Manfredus de Monte Imperiali.²

BOTANY. Gen. Char.—*Calyx* tubular, 5-toothed, imbricated at the base with 2 to 4 opposite scales. *Petals* 5, with long claws. *Stamens* 10. *Styles* 2. *Capsule* 1-celled. *Seeds* compressed, convex on one side, concave on the other; peltate. *Embryo* scarcely curved. (De Cand.)

Sp. Char.—*Stem* branched. *Flowers* solitary. *Scales* of the calyx 4, very

¹ Sprengel, *Hist. Rei Herb.* i. 35.

² Sprengel, *op. supra cit.* i. 299.

short, ovate, somewhat mucronate. *Petals* very broad, beardless. *Leaves* linear-awl-shaped, channelled, glaucous. (De Cand.)

A perennial plant; the origin of the fine carnations of the gardens. *Flowers* pink, purple, white, or variegated; double, semi-double, or single.¹

Hab.—Indigenous. Cultivated in gardens.

DESCRIPTION.—The red or deep crimson gillyflowers (*flores dianthi caryophylli*; *flores caryophylli rubri*; *flores tunicæ*) were formerly employed in medicine on account of their colour. They have a pleasant aromatic smell, and a bitterish sub-astringent taste. They communicate to water their smell and colour.²

COMPOSITION.—I am unacquainted with any analysis of them. They obviously contain a volatile oil, colouring matter, and an astringent principle.

PHYSIOLOGICAL EFFECTS AND USES.—Formerly supposed to have an influence over the nervous system to raise the spirits, &c. Simon Pauli³ recommended them in various nervous and spasmodic affections, and in malignant fever. They have also been used as flavouring and colouring agents; and a syrup of them was formerly contained in the British Pharmacopœias.

ORDER LXXXI. POLYGALÆÆ, De Candolle.—THE MILK-WORT TRIBE.

POLYGALACEÆ, and KRAMERIACEÆ, Lindley.

CHARACTERS.—*Sepals*, 5, imbricate in æstivation, the two interior generally petaliform, the three exterior smaller; two of them are interior, and sometimes united, the third is posterior. *Petals* 3 to 5 hypogynous, more or less united by means of the tube of the stamens (rarely distinct). *Filaments* of stamens adherent to the petals, monadelphous, divided at the apex into two opposite equal phalanges. *Anthers* 8, 1-celled, innate, dehiscing by pores at the apex. *Ovary* 1, free, 2 celled, rarely 1- or 3-celled. *Style* 1. *Stigma* 1. *Pericarp* capsular or drupaceous, 2- or 1-celled. *Valves* septigerous in the middle. *Seeds* pendulous, solitary, often with a carunculate arillus at the base; *embryo* straight, generally in the axis of a fleshy albumen (or rarely), exalbuminous, in which case the endopleura is tumid. *Herbs* or *shrubs*. *Leaves* entire, generally alternate, articulated on the stem. (De Cand.)

PROPERTIES.—Leaves and roots for the most part bitter and astringent.

328. POLYGALA SENECA, Linn. L. E. D.—THE SENEKA.

Sez. Syst. Diadelphia, Octandria.

(Radix, L.—Root, E. D.)

[Senega, U. S.]

HISTORY.—The root of this plant was introduced into medicine as a remedy for the bites of venomous animals, in the early part of the last century, by Dr. Tennant, a Scotch physician, residing in Pennsylvania.⁴

BOTANY. **Gen. Char.**—*Sepals* persistent, the two inner ones wing-like. *Petals* 3 to 5, adnate to the tube of the stamens; the inferior one keel-shaped (perhaps composed of two united). *Capsule* compressed, elliptical, or orbiculate. *Seeds* pubescent, carunculated at the hilum, destitute of a coma. (De Cand.)

Sp. Char.—*Stems* several, somewhat erect, simple, terete. *Leaves* ovate-lanceolate, the upper ones acuminate. *Racemes* somewhat spiked. *Wings* orbiculate. *Capsule* elliptical, emarginate. (De Cand.)

Root perennial, branching. *Stems* annual, from 9 to 12 inches high, occasionally tinged at their lower part with red or purple. *Leaves* alternate, sessile, or on very short stalks, paler beneath. *Flowers* small, white. *Alæ* of the calyx white, with green veins. *Capsule* small, containing two blackish seeds.

¹ For horticultural information respecting them, consult Loudon's *Encyclopædia of Gardening*.

² Lewis, *Mat. Med.*

⁴ *An Epistle to Dr. Mead*, 1742.

³ *Quadrup. Bot.* p. 211.

Hab.—United States of America; most abundant in the southern and western parts.

DESCRIPTION.—*Senega* or *Seneka* root (*radix senegæ* seu *senekæ*), sometimes called the *seneka-snakeroot* or the *rattlesnake root*, is imported from the United States in bales. It varies in size from that of a writing-quill to that of the little finger; it is contorted, presents a number of eminences, and terminates superiorly in an irregular tuberosity, which exhibits traces of numerous stems; a projecting line extends the whole length of the root. The cortical portion is corrugated, transversely cracked, thick, of a grayish-yellow colour. The central portion (*medullium*) is woody and white. The taste of the root is at first sweetish and mucilaginous, afterwards acid and pungent, exciting cough and a flow of saliva; its odour is peculiar and nauseous.

COMPOSITION.—Senega root has been repeatedly made the subject of chemical investigation. In the last century it was examined by Burekhard, by Keilhorn, and by Helmmuth.¹ In 1804 it was analyzed by Gehlen;² and in 1811 by Fougerson.³ Peschier⁴ also published an analysis of it. In 1826 it was analyzed by Feneuille,⁵ in 1827 both by Dulong d'Astafort⁶ and by Folchi,⁷ in 1832 by Trommsdorff,⁸ and in 1836 by Quev  nne.⁹ I subjoin three of these analyses:—

Trommsdorff.		Dulong.		Quev��nne.	
Volatile oil	a trace.	Volatile oil, traces.		Polygalic acid.	
Acrid resin	4.552	Acrid extractive.		Virgineic acid.	
Sweetish bitter extractive	33.570	Yellow extractive.		Tannic acid.	
Pectic acid	10.444	A substance reddened by sulphuric acid.		Pectic acid.	
Wax	0.746	Pectic acid.		Cerin.	
Soft resin	5.222	Wax.		Fixed oil.	
Mucus	5.968	Resin.		Yellow colouring matter.	
Woody fibre	34.316	Gum.		Gum.	
Malates, potash, and lime	2.536	Woody fibre.		Albumen.	
Dried Senega Root	97.354	Malates of potash and lime.		Woody fibre.	
		Mineral salts and iron.		Salts, alumina, silica, magnesia, and iron.	
		Senega Root.		Senega Root.	

1. **POLYGALIC ACID**, in the impure state, was first procured by Gehlen, who called it *Senegin*. It is the active principle, and resides in the cortical part of the root. When pure it is a white, odourless powder, which is at first tasteless, but afterwards communicates an acrid feeling to the mouth, and a sense of constriction to the fauces. It irritates the nostrils and excites sneezing. It is volatile, and, when decomposed by heat in a glass-tube, evolves no ammonia, and hence contains no nitrogen. It is soluble in water and in alcohol, especially when heated by heat; but it is insoluble in ether, acetic acid, and the oils. Its solution forms white precipitates (*polygalates*) with diacetate of lead and protonitrate of mercury. Sulphuric acid has a characteristic effect on polygalic acid; it renders polygalic acid yellow, then rose-red, and afterwards dissolves it, forming a violet-coloured solution, which becomes decolorized in twenty-four hours. The *alkaline polygalates* are not crystallizable. Polygalic acid consists of carbon 55.704, hydrogen 7.529, and oxygen 36.767; or, C²²H¹⁸O¹¹. It has considerable resemblance to esculic acid.¹⁰ Given to dogs in doses of six or eight grains, it causes vomiting, embarrassed respiration, and death in three hours. Two grains thrown into the jugular vein caused vomiting, and, in two hours and a half, death.

5. **VIRGINEIC ACID.**—A volatile, fatty acid, analogous to valerianic, phocenic, and butyric acids. It is an oily liquid, of a reddish colour, a strong, penetrating, disagreeable odour, and an acrid taste. It is soluble in alcohol, ether, and caustic potash, but scarcely so in water.

PHYSIOLOGICAL EFFECTS.—Senega possesses acrid and stimulant properties. In small doses it is diaphoretic, diuretic, and expectorant; in larger doses, emetic and purgative. Sundelin¹¹ took a scruple of powdered senega root every two hours for six hours; it caused irritation of the back part of the tongue and throat, and gave rise to an increased flow of saliva. These effects were soon followed by considerable burning in the stomach, nausea, and vomiting. The skin became warmer and moister; there was griping pain of the bowels, followed by watery evacuations;

¹ Murray, *App. Med.* ii. 564.

² *Journ. de Chim. M  d.* ii. 549.

³ *Journ. de Chim. M  d.* iii. 431.

⁴ *Journ. de Chim. M  d.* iii. 600.

⁵ *Journ. de Pharm.* xxii.

¹¹ *Handb. d. spec. Heilmittell.* ii. 176, 3te Aufl.

² Gmelin, *Handb. d. Chem.* ii. 1249.

⁴ Quoted by Goebel and Kunze, *Pharm. Waarenk.*

⁶ *Journ. de Pharm.* xiii. 567.

⁸ *Pharm. Central-Blatt f  r 1832*, S. 449.

¹⁰ *Journ. de Pharm.* xxiii. 270.

the secretion of urine was increased, and a feeling of heat was experienced in the urinary passages. For some days after, there was gastric uneasiness with loss of appetite. In larger doses, it caused burning pain in the stomach and bowels, violent vomiting, purging, anxiety, and giddiness.

It appears to excite moderately the vascular system, to promote the secretions (at least those of the kidneys, skin, uterus, and bronchial membrane), and to exert a specific influence over the nervous system. It has been principally celebrated for its expectorant effects.

In its operation on the nervous system, it has considerable resemblance to Arnica; but its influence over the secreting organs is much greater. It is somewhat analogous to Helenium in its action.

USES.—In this country, senega is comparatively but little employed. It is an exceedingly valuable remedy in the latter stages of *bronchial* or *pulmonary inflammation*, when this disease occurs in aged, debilitated, and torpid constitutions, and when the use of depletives is no longer admissible. It appears to re-establish a healthy condition of the secreting organs, to promote the resolution of the morbid deposits, and to give strength to the system. I usually administer it in combination with ammonia, which appears to me to promote its beneficial operation. Frequency of pulse, and a febrile condition of the system, are by no means to be regarded as impediments to the use of this medicine.

In *chronic catarrh* and *humoral asthma* it has also been used. It has been extravagantly praised by Dr. Archer, of Maryland, as a remedy for *croup*.¹ He represents it as being capable, without the aid of any other means, of removing this alarming disease. Few practitioners, I suspect, would venture to trust it. Yet it might be a useful addition to emetics. As a stimulant and promoter of the secretions, it has been used with advantage in the latter stage of low *fever* accompanied with torpidity. It has also been used as an emetic, purgative, and diaphoretic, in *rheumatism*, as a diuretic in *dropsy*, and as an emmenagogue in *amenorrhœa*. It was introduced into practice as a remedy against the bite of venomous animals, as the rattlesnake.

ADMINISTRATION.—The dose of the *powder* is from grs. x to ℥j. But the *infusion* or *decoction* is the best form of exhibition.

1. DECOCTUM SENEGE, L. [U. S.]; *Decoction of Senega*.—(Senega Root ℥x [℥i, U. S.]; Distilled Water two pints [Water Oiss, U. S.]. Boil down to a pint, and strain.)—Stimulating, expectorant, and diuretic. Dose, f℥j to f℥iij, three or four times daily. Ammonia is often a valuable addition to it.

[2. INFUSUM POLYGALÆ, D.—(Polygala Root, bruised, ℥ss; Boiling Water ℥ix. Digest for one hour in a covered vessel, and strain.)—The product should measure about eight ounces.—Ed.]

[3. INFUSUM SENEGE, E; *Infusion of Senega*.—(Take of Senega ℥x; Boiling Water one pint. Infuse for four hours in a covered vessel, and strain.)—Ed.]

[4. SYRUPUS SENEGE, U. S. *Syrup of Senega*.—(Take of Senega, bruised, four ounces; Water a pint; Sugar a pound. Boil the Water with the Senega to one-half, and strain; then add the Sugar, and proceed in the manner directed for Syrup. Or, take Senega in coarse powder four ounces; Water a sufficient quantity; Sugar fifteen ounces. Mix the Senega with four fluidounces of Water, and allow the mixture to stand for twelve hours; then put it into an open apparatus for displacement, and gradually pour water upon it until the liquid passes nearly tasteless. Evaporate the filtered liquor to half a pint, strain, and having added the Sugar, proceed as for Syrup.)—This preparation possesses all the advantages of the decoction, to which, moreover, it is superior, in its acceptability to the patient. It may be employed by itself, or it may be combined with other articles and employed in the form of cough mixture. The dose is f℥i or f℥ij.

¹ Eberle, *Mat. Med.*

5. **EXTRACTUM SENEGÆ**; *Extract of Seneka*.—(To make this preparation, a formula has been given by Mr. Procter, in *Am. Journ. of Pharmacy*, vol. xiv. p. 287. Take of Seneka, in coarse powder, ℥xvj; Alcohol Oij; Water Oiv. Mix the Alcohol and Water, and macerate the Seneka in one half of it for two days, place the mixture in a displacement apparatus, and operate with the same menstruum until six pints of tincture are obtained. Evaporate this on a water-bath till reduced to the consistence of an extract. One drachm of this extract dissolved in a pint of water yields a preparation of the same theoretical strength, but greater actual strength than the official decoction. It may be used in the same manner as the preceding, by combination.]

329. **KRAMERIA TRIANDRA**, Ruiz and Pavon, *L. E. D.*—**THE RHATANY.**

Sex. Syst. Tetandria, Monogynia, Willd.
(Radix, L.—Root, E. D.)

HISTORY.—This plant was discovered by Ruiz and Pavon, in 1779, in South America. It was introduced to notice into this country, as a medicine, by Dr. Reece, in 1808. In 1813, Ruiz's dissertation on it appeared in an English dress.¹

BOTANY.—**Gen. Char.**—*Sepals* 4 or 5, irregular, coloured, spreading, deciduous. *Petals* 4 or 5, irregular, smaller than the calyx, the 3 inner unguiculate. *Stamens* 1, 3, or 4, hypogynous, unequal. *Ovary* 1-celled, or incompletely 2-celled; *style* terminal; *stigma* simple; *ovules* in pairs, suspended. *Fruit* between hairy and leathery, globose, covered with hooked prickles, by abortion 1-seeded, indehiscent. Spreading, many-stemmed *undershrubs*. *Leaves* alternate, simple, entire, or 3-foliate, spreading. *Racemes* simple, spiked (Lindley).

Sp. Char.—*Leaves* oblong, somewhat acute, villous-silky. *Pedicels* somewhat longer than the leaf, bibracteate, forming a short *raceme*. (De Cand.)

Suffruticose. *Root* long, branching. *Stem* procumbent, branching. *Leaves* sessile, covered on both surfaces with long, silky leaves. *Flowers* solitary, lake-coloured. *Stamens* 3. *Drupe* round, beset with stiff reddish hairs.

Hab.—Peru; growing abundantly in Huanuco, Huamalies, and Canta.

DESCRIPTION.—Rhatany root (*radix krameriæ seu rhatanhiæ*) is brought from Peru. It consists of numerous woody, cylindrical, long branches, varying in thickness from that of a writing-quill upwards. These pieces consist of a slightly fibrous, reddish-brown bark, having an intensely astringent and slightly bitter taste, and of a very hard, ligneous medullium, of a yellowish or pale red colour. The largest quantity of astringent matter resides in the bark, and therefore the smaller branches (which have a larger proportion of bark) are to be preferred.

Foreign or South American extract of rhatany (extractum krameriæ seu rathanhiæ americanum) is occasionally imported.

COMPOSITION.—Rhatany root has been analyzed by Trommsdorff, Vogel, C. G. Gmelin, and Peschier.²

<i>C. G. Gmelin.</i>		<i>Peschier.</i>	
Tannin	38.3	Dried watery extract	31.25
Sweet matter	6.7	Insoluble matters	68.75
Mucilage	8.3		
Nitrogenous ditto	2.5	Rhatany Root	100.00
Lignin	43.3		
[Loss	0.9]		
Rhatany Root	100.0		
		Tannin	42.6
		Gallie acid	0.3
		Gum, extractive, and colouring matter	56.7
		Krameric acid	0.4
		Dried Watery Extract of Rhatany Root	100.0

1. **TANNIC ACID.**—To this, as well as in part to a minute portion of gallic acid, rhatany root owes its astringent qualities. It is this acid which enables an infusion of rhatany root to form,

¹ Eckard, *Diss. Inaug. de Rad. Ratanhiæ*, Berol. 1822.

² L. Gmelin, *Handb. d. Chem.* ii. 125.

with a solution of gelatine, a precipitate (*tannate of gelatine*), and with sesquichloride of iron a brownish-gray precipitate (*tannate of iron*). The properties of tannic acid have been already described.

2. **KRAMERIC ACID.**—Peschier ascribes the stypticity of rhatany to this acid, the properties of which are at present imperfectly known.

PHYSIOLOGICAL EFFECTS.—A powerful astringent, and, like other agents of this class, tonic also. (See the effects of astringents, *ante*.)

USES.—Rhatany root is adapted to all those cases requiring the employment of astringents; such as *profuse mucous discharges* (as humid catarrh, old diarrhœas, fluor albus, &c.), *passive hemorrhages* (especially metrorrhagia), and *relaxation and debility of the solids*. It is sometimes used as a *tooth powder* (as with equal parts of orris root and charcoal). Dentists sometimes employ tincture of rhatany diluted with water as an *astringent mouth wash*.

ADMINISTRATION.—The *powder* may be given in doses of from grs. x to ʒss. The *infusion* or *extract* is more commonly employed. *Compound tincture of rhatany* is prepared by digesting ʒiij of bruised rhatany root, and ʒij of orange peel, in Oj of proof spirit. Sometimes ʒss of serpentine root and ʒj of saffron are added. It is an efficacious astringent and stomachic.—Dose, fʒj to fʒiij.

1. **INFUSUM KRAMERIÆ**, L. D.; *Infusion of Rhatany*.—(Krameria ʒj [ʒss D.]; Boiling Distilled Water Oj, [ʒix D.] Macerate for four hours [one hour, D.] in a lightly covered vessel, and strain. (The product should measure about eight ounces, D.)—Astringent and tonic. Dose, fʒj to fʒiij.

2. **EXTRACTUM KRAMERIÆ**, E.; *Extract of Rhatany*.—(Prepared as extract of liquorice. [A better mode is by evaporation of the displaced infusion.] Astringent.)—Dose, grs. x to ʒj.

3. **TINCTURA KRAMERIÆ**, U. S. *Tincture of Rhatany*.—(Rhatany in powder ʒvi; Diluted Alcohol Oij. Macerate for fourteen days, and strain, or prepare by displacement.)—Used as an adjunct to cretaceous mixtures, or with tonics. The dose is fʒj to fʒiij. It may be employed diluted with water as a gargle.]

4. **SYRUPUS KRAMERIÆ**, U. S. *Syrup of Rhatany*.—(Extract of Rhatany ʒij; Water Oj; Sugar lb ijss. Dissolve the extract in the water, and make the solution into a syrup. A pleasant astringent, used in diarrhœas, chronic dysentery, and hemorrhages.)—Dose, fʒj to fʒss.]

ORDER LXXXII. VIOLACEÆ, Lindley.—THE VIOLET TRIBE.

VIOLARIÆ, De Candolle.

CHARACTERS—*Sepals* 5, persistent, with an imbricate æstivation, usually elongated at the base. *Petals* 5, hypogynous, equal or unequal, usually withering, and with an obliquely convolute æstivation. *Stamens* 5, alternate with the petals, usually opposite them, inserted on a hypogynous disk, often unequal; *anthers* bilocular, bursting inwards, either separate or cohering, and lying close upon the ovary: *filaments* dilated, elongated beyond the anthers; two, in the regular flowers, generally furnished with an appendage or gland at their base. *Ovary* 1-celled, many-seeded, or rarely 1-seeded, with 3 parietal placentæ opposite the three outer sepals; *style* single, usually declinate, with an oblique hooded *stigma*. *Capsule* of 3 valves, bearing the placentæ in their axis. *Seeds* often with a tumour at their base; *embryo* straight, erect, in the axis of fleshy *albumen*.—*Herbaceous* plants or *shrubs*. *Leaves* simple, usually alternate, sometimes opposite, stipulate, entire, with an involute *venation*. *Inflorescence* various (Lindley).

PROPERTIES.—Roots more or less emetic.

330. *VIOLA ODORATA*, Linn. L. E.—THE SWEET VIOLET.

Sex. Syst. Pentandria, Monogynia.
(*Petalum recens*, L.—Flowers, E.)

HISTORY.—According to Dr. Sibthorp,¹ this is the *Ἰὼν πορφυρέν* (*purple violet*) of Dioscorides.² It was employed in medicine by Hippocrates.

BOTANY.—**Gen. Char.**—*Sepals* 5, unequal, prolonged into appendages at the base. *Corolla* unequal, 2-lipped, of 5 petals, the lower calcarate. *Capsule* bursting with elasticity, many-seeded, 3-valved.—*Herbaceous* plants (Lindley).

Sp. Char.—*Stigma* uncinatè, naked. *Leaves* rounded cordate. *Sepals* ovate, obtuse. *Spur* very blunt. *Capsule* turgid, hairy. *Seeds* turbinate, pale. *Runners* flagelliform. (De Cand.)

Perennial. *Flowers* fragrant, deep purple, often white, occasionally lilac. *Bracts* inserted above the middle of the scape.

Hab.—Indigenous. *Flowers* in March and April. Cultivated on account of the odour and colour of the flowers.

DESCRIPTION.—Violets (*flores violæ odoratæ*) should be gathered immediately they are expanded, as they subsequently become purplish. Their delightful fragrance is well known. The root of the violet (*radix violæ odoratæ*) has been used in medicine.

COMPOSITION.—In 1822, Pagenstecher³ detected the following substances in an infusion of the flowers: *Odorous principle*, *blue colouring matter*, *sugar* both *crystallizable* and *uncrystallizable*, *gum*, *albumen*, and *salts of potash* and *lime*. Boullay⁴ obtained from the *root*, *leaves*, *flowers*, and *seeds* an acrid principle, which he has termed *violine*.

1. **ODOROUS PRINCIPLE.**—This has not been isolated. It is supposed, however, to be of the nature of volatile oil. By digesting violets in olive oil, the latter dissolves the odorous matter, and acquires the smell of violets: this preparation is the *oil of violets*, the *huile de violette* of perfumers. The *eau* or *esprit de violette* is nothing more than an alcoholic tincture of the rhizome of the Florentine orris, which has an odour similar to that of the violet.

2. **COLOURING MATTER.**—It is soluble in water, but not in alcohol. It is changed to red by the strong acids, and to green by the alkalis: hence, the expressed juice and syrup are valuable as tests for discovering the existence of either acids or alkalis. An infusion of violets has been said to contain three kinds of colouring matter; namely, a *blue colouring matter*, not precipitable by the acetate of lead, but which is completely decolorized by sulphuretted hydrogen; secondly, a *bright-red acid colouring matter*, which causes a bluish-green precipitate with the solution of acetate of lead; thirdly, a *violet-red colouring matter*, which does not precipitate the neutral acetate of lead, but throws down a greenish-yellow precipitate with the subacetate of lead.

3. **VIOLINE** (*Emetine indigène*).—It was at first mistaken for *Emetina*. Its nature requires farther investigation. It is a white powder, of a bitter acrid taste, slightly soluble in water, and insoluble in ether. It is precipitated from its solution by infusion of nutgalls. Its operation is similar to that of emetine.

PHYSIOLOGICAL EFFECTS.—The *odorous emanations* of violets, like those of some other flowers, are said to have occasionally proved dangerous, and in one case were supposed to have brought on apoplexy.⁵ Dr. Lindley⁶ has known them cause faintness and giddiness. *Taken internally*, violets act as laxatives. The *seeds* possess similar properties. The *root*, in doses of from \mathfrak{z} ss to $\mathfrak{z}\mathfrak{j}$, proves emetic and purgative.

USES.—Violets are employed in the preparation of the officinal syrup. They are useful as a test for acids and alkalis, and are much sought after for bouquets. The root might be employed as a substitute for ipecacuanha.

SYRUPUS VIOLE, L. E.; Syrup of Violets.—(Of the Violet $\mathfrak{z}\mathfrak{i}\mathfrak{x}$; Boiling Dis-

¹ *Prodr. Fl. Græc.* i. 117.

² Gmelin, *Handb. d. Chem.* ii. 1249.

³ Trillel, quoted by Murray, *App. Med.* i. 178.

⁴ Lib. iv. cap. 122.

⁵ *Journ. de Pharm.* x. 23.

⁶ *Flora Medica.*

tilled Water Oj ; Sugar lbij, or a sufficiency ; Rectified Spirit ℥iiss, or a sufficiency. Macerate the violet in water for twelve hours, then express and strain.—Set aside that the dregs subside, and proceed as directed for the Syrupus Althææ, *L.* (Fresh Violets, *L.* lbj ; Boiling Water Oiiiss ; Pure Sugar lbviiss. Infuse the flowers for twenty-four hours in the water [in a covered glass or earthenware vessel, *E.*] ; strain without squeezing, and dissolve the sugar in the filtered liquor, *E.*)—The colour of this preparation is improved by making it in a tin or pewter vessel. No satisfactory explanation of this has been offered. The Edinburgh College, fearful, I presume, of metallic impregnation, direct glass or earthenware vessels to be employed.—Genuine syrup of violets is readily distinguished from any counterfeit by

Fig. 401.

Root of *Ionidium Ipecacuanha*.

its being reddened by an acid, and made green by an alkali. Hence it is employed as a test.—As a medicine it is used as a mild laxative for new-born infants. Thus, a mixture of equal parts of oil of almonds and syrup of violets is often administered, in the dose of one or two teaspoonfuls, for the purpose mentioned.

OTHER MEDICINAL VIOLACEÆ.

The roots of several species of *Ionidium* possess emetic qualities, and have been employed as substitutes for our official ipecacuanha (*Cephaelis Ipecacuanha*).

The root of *IONIDIUM IPECACUANHA*, a native of the Brazil, is termed *False Brazilian Ipecacuanha*. It yielded Pelletier five per cent. of emetine. The dose of it, as an emetic, is ℥ss to ℥j infused in water.

The root of the *IONIDIUM MICROPHYLLUM*, or the *Cuchunchully*, a native of Quito, possesses similar properties.

Dr. Bancroft¹ speaks favourably of it in Elephantiasis tuberculata. But the specimens which he sent home as *Cuchunchully* are said by Sir W. Hooker to be identical with *Ionidium parviflorum*, Vent. Dr. Lindley,² however, received from the Hon. W. F. Strangways, the "*Cuchunchully* de Cuenca," which was the *I. microphyllum* of Humboldt.

ORDER LXXXIII. CISTACEÆ, *Lindley*.—THE ROCK-ROSE TRIBE.

CISTI, *Jussieu*. CISTOIDEÆ, *Ventenat*. CISTINÆ, *De Candolle*.

Fig. 402.

*Cistus creticus*.

The substance called **LADANUM** is a resinous exudation from the *Cistus creticus*, growing, as its name implies, in Crete. In the time of Dioscorides it was collected by combing the beards of the goats which browse on the plant. According to Tournefort³ and Sieber, it is now collected by a kind of whip or rake, with a double row of leathern thongs. With this the countrymen brush the plants, and when the whips are sufficiently laden with the juice, it is scraped off by knives, and made into cakes. Pure ladanum consists of resin and volatile oil 86, wax 7, aqueous extract 1, and earthy matters and hairs 7 (Guibourt). Pelletier found 72 per cent. of sand in it. It possesses stimulant properties, and was formerly a constituent of some plasters. Its use is now obsolete.

¹ *Comp. to Bot. Mag.* i. 278.

² *Voyage into the Levant*, i. 79, 1741.

³ *Flora Medica*, p. 95.

ORDER LXXXIV. CRUCIFEREÆ, *Jussieu*.—THE CABBAGE OR CRUCIFEROUS TRIBE.BRASSICACEÆ, *Lindley*.

CHARACTERS.—*Sepals* 4, deciduous cruciate. *Petals* 4, cruciate, alternate with the sepals. *Stamens* 6, of which two are shorter, solitary, opposite the lateral sepals, and occasionally toothed; and four larger, in pairs, opposite the anterior and posterior sepals, generally distinct, sometimes connate, or furnished with a tooth on the inside. *Disk* with various green glands between the petals, and the stamens and ovary. *Ovary* superior, unilocular, with parietal placentæ usually meeting in the middle, and forming a spurious dissepiment. *Stigmas* 2, opposite the placentæ. *Fruit* a silique or silicule, 1-celled, or spuriously 2-celled; 1- or many-seeded; dehiscing by two valves separating from the replum; or indehiscent. *Seeds* attached in a single row by a funiculus to each side of the placentæ, generally pendulous. *Albumen* none. *Embryo* with the radicle folded upon the cotyledons.—*Herbaceous* plants, annual, biennial, perennial, very seldom suffruticose. *Leaves* alternate. *Flowers* usually yellow or white, seldom purple (*Lindley*).

PROPERTIES.—Pungent stimuli. They furnish nutritive, condimentary, and antiscorbutic substances. Their pungency depends on an acid volatile oil, composed of *carbon, nitrogen, hydrogen, sulphur, and oxygen*. This oil becomes absorbed, and in some cases is detectable in the secretions. The nutritive properties of crucifereæ arise from their mucilaginous, saccharine, and extractive constituents. *Cakile maritima* is purgative. *Cheiranthus lividus* is said to be dangerous to goats; while *Lepidium piscidium*, we are told, stupefies fish. These statements, however, require farther proof. With these doubtful exceptions, none of the crucifereæ are poisonous.

Fig. 403.



A Silique.

331. CARDAMINE PRATENSIS, *Linn.*—CUCKOO-FLOWER.

Sex. Syst. Tetradynamia, Siliquosa.

HISTORY.—Brunfels and Tragus are the earliest writers in whose works an undoubted notice of this plant appears.¹

BOTANY. *Gen. Char.*—*Silique* linear, with flat, nerveless valves, which often separate elastically. *Seeds* ovate, not bordered (O=). *Umbilical cords* slender. (*De Cand.*)

Sp. Char.—*Leaves* pinnatisect; segments of the radical ones somewhat rounded—of the cauline ones, linear or lanceolate, entire. *Style* very short, scarcely more slender than the silique; *stigma* capitate. (*De Cand.*)

Root perennial. *Stem* about a foot high. *Flowers* light purple, flesh-coloured, or white.

Hab.—Indigenous; meadows and moist pastures. Flowers in April and May.

DESCRIPTION.—The flowers (*flores cardamines*) are somewhat bitter and pungent, and have a slight odour. By drying they become inodorous and almost insipid. The leaves possess a flavour analogous to, though less agreeable than, the common water-cress.

COMPOSITION.—I am unacquainted with any analysis of the plant worth quoting. The pungency depends on *volatile oil*, the bitterness on *extractive matter*. A few experiments on this plant are mentioned by Gronhert.²

PHYSIOLOGICAL EFFECTS AND USES.—The flowers of cardamine are said to be stimulant, diaphoretic, diuretic, and nervine. They were formerly used in epilepsy, especially when it occurred in children, but have now fallen into almost total disuse. They were recommended by Sir George Baker³ in cholera and spasmodic asthma. Dose of the dried flowers, ʒij or ʒiij.

¹ Sprengel, *Hist. Rei Herb.*² *Med. Trans.* i. 442.³ *Spec. Inaug. Resiomonti*, 1785.

332. COCHLEARIA ARMORACIA, Linn. L. E.—HORSERADISH.

Sex. Syst. Tetradynamia, Siliculosa.
(Radix recens, L.—Fresh root, E.)

HISTORY.—Sprengel¹ considers this plant to be the *ῥαφανὶς ἀγρία* of Dioscorides;² and Dierbach³ suggests that it was known to Hippocrates. But these opinions are by no means well established.

BOTANY. *Gen. Char.*—*Silicule* sessile, ovate-globose or oblong, with ventricose valves. *Seeds* many, not bordered. *Calyx* equal, spreading. *Petals* entire. *Stamens* not toothed.—(O=). *Flowers* white. *Leaves* often somewhat fleshy. (De Cand.)

Sp. Char.—*Silicules* ellipsoid. Radical *leaves* oblong, crenate; cauline ones elongated, lanceolate, dentate, or incised. *Root* fleshy, large. (De Cand.)

Root perennial, long, cylindrical, white, very pungent. *Stems* two feet high. *Leaves* much veined. *Flowers* white.

Hab.—Indigenous; extensively cultivated. *Flowers* in May.

DESCRIPTION.—Horseradish root (*radix armoraciæ*; *radix raphani rustici*) evolves, when scraped into shreds, a highly penetrating acrid vapour. Its taste is very pungent. It is coloured blue by tincture of iodine. An infusion of it is tinged reddish yellow by the sesquisalts of iron.

COMPOSITION.—Horseradish root was analyzed by Gutret,⁴ who found its constituents to be—acrid volatile oil, bitter resin, extractive sugar, gum, starch, woody fibre, vegetable albumen, acetic acid, and acetate and sulphate of lime.

VOLATILE OIL (*Oleum Armoracæ*).—Obtained by distillation without water. It is pale yellow, heavier than water, and very volatile. Its odour is exceedingly powerful, and like that of Horseradish. One drop is sufficient to infect a whole room. Its taste is at first sweetish, then burning and acrid. It causes inflammation and vesication when applied to the skin. It is slightly soluble in water, easily so in alcohol. The watery solution yields, with acetate of lead, a brown precipitate (*sulphuret of lead*); with nitrate of silver, a black one (*sulphuret of silver*). [It contains sulphur and nitrogen, but no oxygen. It has lately been shown to be identical with Volatile Oil of Mustard.—Ed.]

PHYSIOLOGICAL EFFECTS.—Horseradish is a well-known pungent, acrid stimulant, capable of producing vesication when applied to the skin, and of causing vomiting when taken, in the form of infusion, into the stomach. Its odorous emanations readily excite a copious flow of tears. On the general system it operates as a stimulant, and promotes both urine and perspiration.

USES.—Scraped in shreds, it is used at the table as a condimentary accompaniment to roast beef. It is not much employed as a medicine. Chewed, it serves as an excellent masticatory. Taken in this way, or in the form of syrup, it may be serviceable in some forms of hoarseness. An infusion of it may be taken to excite vomiting, or to promote the operation of other emetics, as in poisoning by narcotic substances. As a general stimulant, diaphoretic, and diuretic, it has been used in palsy, chronic rheumatism, and dropsy. It is one of the remedies deemed antiscorbutic.

ADMINISTRATION.—Dose, ʒss or more, scraped into shreds.

1. INFUSUM ARMORACIÆ COMPOSITUM, L.; *Compound Infusion of Horseradish.*—(Horseradish, sliced; Mustard-seeds, bruised, of each ʒi; Compound Spirit of Horseradish fʒj; Boiling Distilled Water Oj. Macerate the root and seeds in the water for two hours in a lightly covered vessel, and strain. Then add the compound spirit of Horseradish).—This preparation soon undergoes decomposition. It is stimulant and diuretic, and has been employed in chronic rheumatism, paralysis, dropsies, and scurvy.—Dose, fʒj to fʒij.

¹ *Hist. Rei Herb.* i. 182.

² *Arzneim. d. Hippok.* 125.

³ *Lib.* ii. 138.

⁴ *Gmelin, Handb. d. Chem.* ii. 1248.

2. SPIRITUS ARMORACIÆ COMPOSITUS, L.; *Compound Spirit of Horseradish*.—(Horseradish, sliced; Dried Orange Peel, of each ℥xx; Nutmegs, braised, 3v; Proof Spirit, Cong. j; Water Oij. Mix, and let a gallon distil by a gentle heat).—Usually employed as a stimulating adjunct to other medicines, especially to diuretic infusions. Dose, fʒj to fʒiv.

333. COCHLEARIA OFFICINALIS, Linn.—COMMON SCURVY-GRASS.

Sex. Syst. Tetradynamia, Siliculosa.
(Herba.)

HISTORY.—This plant does not appear to have been known to the ancients.

BOTANY.—*Gen. Char.*—See *Cochlearia Armoracia*.

Sp. Char.—*Silicules* ovate-globose, twice as short as their pedicels. Radical leaves stalked, cordate; cauline ones ovate dentate-angular. (De Cand.)—*Annual*. Stem about a foot high. Flowers pure white.

Hab.—Indigenous; on the sea-coast and in watering-places on the Welsh and Scottish mountains. Cultivated in gardens.—Flowers in April and May.

DESCRIPTION.—Scurvy-grass (*herba cochleariæ*) evolves, when rubbed, a somewhat pungent odour. Its taste is penetrating and acrid.

COMPOSITION.—The *inspissated juice* was examined by Braconnot,¹ and the *fresh herb* by Gutret.² The latter obtained from it the following constituents: *volatile oil, bitter resin, bitter extractive, gum, green fecula, vegetable albumen, hydrochlorate and sulphate of ammonia, nitrate and sulphate of lime*.

VOLATILE OIL (*Oleum Cochleariæ*).—This oil is identical with the oil of horseradish (*ante*, p. 1000).

PHYSIOLOGICAL EFFECTS AND USES.—A gentle stimulant, aperient, and diuretic. It has long been esteemed as an antiscorbutic.³ It has also been used in visceral obstructions. It is occasionally eaten with bread and butter, like the water-cress. [Formerly introduced into the Dublin Pharmacopœia, now omitted.—ED.]

334. SINAPIS NIGRA, Linn. L. E. D.—COMMON OR BLACK MUSTARD.

Sex. Syst. Tetradynamia, Siliquosa.

(Semen, L.—Flour of the seeds, generally mixed with those of *Sinapis alba*, and deprived of fixed oil by expression, E.—The flour of the seeds, D.)

HISTORY.—Mustard (ράπυ) was employed in medicine by Hippocrates.

BOTANY. *Gen. Char.*—*Silique* somewhat terete; the valves nerved. *Style* small, short, acute. *Seeds* in one row, somewhat globose. *Calyx* spreading. (De Cand.)

Sp. Char.—*Siliques* smooth, even, somewhat tetragonal, pressed close to the peduncle. Lower leaves lyrate; upper ones lanceolate, quite entire, stalked.—*Annual*. Stem 3 or 4 feet high. Flowers yellow.

Hab.—Indigenous; hedges and waste places. Cultivated in fields, especially in Durham and Yorkshire.

DESCRIPTION.—Black mustard seeds (*semina sinapis nigræ*) are small and roundish. Externally they are beautifully veined, and of a reddish or blackish-brown colour, though sometimes whitish. Internally they are yellow. They are inodorous, but have an acrid, bitter, oleaginous taste.

¹ *Journ. Phys.* lxxiv. 278.

² See Valentinus, *Cochlearia curiosa*, by Shirley, 1676.

³ Gmelin, *Handb. d. Chem.* ii. 1248.

Fig. 404.

a. *Sinapis alba*. b. *Sinapis nigra*.

Simon;⁶ by Bussy;⁷ and by Bouton and Frémy.⁸ From their labours we learn that black mustard seed contains *myronate of potash*, *myrosine*, *fixed oil*, a *pearly fatty matter*, *gummy matter*, *sugar*, *colouring matter*, *sinapisin*, *free acid*, *peculiar green matter*, *salts*.

1. **MYRONIC ACID.**—So called by Bussy, its discoverer, from *μύρον*, an *odorous oil*. It is an inodorous, non-volatile, bitter, non-crystallizable acid. It is soluble in water and alcohol; but not in ether. It is composed of *carbon*, *sulphur*, *hydrogen*, *nitrogen*, and *oxygen*. The alkaline myronates are crystallizable. Myronate of potash yields no precipitate with nitrate of silver, nitrate of baryta, acetate of lead, corrosive sublimate, or chloride of calcium. The characteristic property of myronic acid is, to yield the *volatile oil of mustard* when mixed with myrosine and water. [This acid in mustard seed is combined with potash, forming myronate of potash, which is identical with the *sulpho-sinapisin* of Henry.—ED.]

2. **MYROSINE**; *Emulsin of Black Mustard*.—Bussy called it myrosine, from *μύρον*, *odorous oil*, and *συν*, *with*, because it yields, with myronic acid and water, the volatile oil of mustard. It has considerable resemblance to vegetable albumen and emulsin; but as it cannot be replaced by either of these substances, in the development of the volatile oil, it must be regarded as a substance *sui generis*. It is soluble in water; but is coagulated by heat, alcohol, and acids, and in this state it loses the power of acting on the myronates, and of yielding the volatile oil.

3. **SINAPISINE.**—This term has been given, by Simon, to a substance which he procured from black mustard seeds, and which, he states, possesses the following properties: It presents itself in the form of white, brilliant, micaceous, volatile crystals, which are soluble in alcohol, ether, and the oils, but are insoluble in acids and alkalies. When mixed with the albumen (myrosine) of the mustard seed, it yields the volatile oil of mustard. Bussy ascribes this last property to myronic acid. It is highly improbable that two constituents of mustard should possess it. Analogy would lead us to suppose that the oil is generated by non-acid substances. Simon says sinapisine contains no sulphur. Myronic acid contains sulphur.

4. **VOLATILE OIL OF MUSTARD.**—This does not pre-exist in the seeds; but is formed when water is added to the farina, by the mutual action of the contained myrosine and myronate of potash (sinapisine?), just as the volatile oil of bitter almonds is generated by the mutual action of emulsin, amygdalin, and water (see p. 768). Alcohol extracts from the farina no volatile oil; but, by coagulating the myrosine, renders the farina incapable of developing the oil by the

MANUFACTURE OF MUSTARD.—The following method of preparing *flour of mustard* (*farina sinapis*) was kindly furnished me by a manufacturer: The seeds of both black and white mustard are first crushed between rollers, and then pounded in mortars. The pounded seeds are then sifted. The residue in the sieve is called *dressings* or *siftings*: what passes through is *impure flour of mustard*. The latter by a second sifting yields *pure flour of mustard*, and a second quantity of dressings. The *common flour of mustard* of the shops is adulterated with flour (wheaten), coloured by turmeric, and rendered hot by pod pepper. By pressure the dressings or siftings yield a fixed oil (*fixed oil of mustard*), which is used for mixing with rape and other oils. The whole seeds are never pressed. Mustard cake is employed as a manure, being too hot for cattle.

COMPOSITION.—Black mustard seed was analyzed by Thibierge.¹ Some of its constituents have subsequently been examined by Henry fils and Garot;² by Pelouze;³ by Robiquet and Boutron;⁴ by Fauré;⁵ by

¹ *Journ. de Pharm.* v. 439.

² *Journ. de Chim. Méd.* i. 439 and 467; and *Journ. de Pharm.* xvii. 1.

³ *Journ. de Pharm.* xvii. 290.

⁴ *Ibid.* xxv. 366.

⁵ *Ibid.* p. 48.

⁶ *Journ. de Chim. Méd.* vi. 577.

⁷ *Ibid.*

⁸ *Ibid.* xxvi. 39.

subsequent action of water. Sulphuric acid and the other mineral acids, as well as carbonate of potash, check the formation of the oil. But when the oil is once formed, the acids have no power to prevent its effects. Volatile oil of mustard is colourless or pale yellow; it has a most penetrating odour, and a most acrid burning taste. Its sp. gr. at 68° F. is 1.015 (1.038). It boils at 290° F. It is slightly soluble in water, but readily so in alcohol and ether. By the action of ammonia on this oil, a white, odourless, crystallizable substance (an *amide*?) is produced, which consists of one atom of the oil, and one atom of ammonia, $C^8H^5NS^2 + NH^3$.¹ These crystals are decomposed with the greatest facility by binocide of mercury.² [Volatile oil of mustard is represented by the formula $C^8H^5NS^2$. According to Wertheim, this oil is the sulphocyanide of allyle ($All=C^6H^5$). This is theoretically consistent with the constitution above given for $C^6H^5C^2NS^2=C^8H^5NS^2=All,CyS^2$.—Ed.] It is powerfully acrid, rubefacient, and vesicant. It has been proposed as a rubefacient in paralysis, and as a vesicant. The distilled water of mustard has been employed against the itch.³

5. FIXED OIL OF MUSTARD.—Usually procured from the dressings or siftings of mustard above referred to. It constitutes about 28 per cent. of the seeds. Its colour is reddish or brownish-yellow. It has a faint odour of mustard, and a mild oily taste. It does not readily become rancid. It has been used as a purgative and anthelmintic.⁴

PHYSIOLOGICAL EFFECTS.—Mustard is an acrid stimulant belonging to the group of the *volatile pungent stimuli*. It holds an intermediate rank between horseradish and pepper. Its topical action is that of a powerful acrid, and depends on the volatile oil developed by the action of water. The irritant operation, on the eyes, of the vapour arising from a mixture of hot water and flour of mustard, is familiarly known. Mustard cataplasms cause redness and burning pain, which, if the application be continued, becomes almost insupportable. A prolonged application causes vesication, with even ulceration and gangrene. Compared with those of cantharides, the topical effects of mustard on the skin sooner subside when the application is discontinued. When swallowed, mustard evinces the same stimulant operation on the stomach and bowels. Taken in moderate quantities, with the food, it promotes the appetite, and assists the assimilation of substances which are difficult of digestion. In somewhat larger doses (as one or two teaspoonsful) it rouses the gastric susceptibility, and operates as an emetic. In excessive quantities it gives rise to vomiting, purging, and gastro-enteritis. The effects of mustard on the general system are those of a stimulant. It quickens the pulse, and promotes the secretions (especially the urine) and the exhalations.

USES.—The dietetical uses of mustard are well known. It is well adapted for cold, phlegmatic individuals, with a torpid or atonic condition of the digestive organs. It is an excellent condimentary adjunct to heavy and difficultly digestible foods, as fatty matters.

As a medicinal agent, mustard is employed for several purposes. As an *emetic* it is useful where we want to rouse the gastric sensibility, as in narcotic poisoning, malignant cholera, and some forms of paralysis.⁵ As a *stimulant* to the digestive organs, it is applicable in atonic or torpid conditions of these parts, with dyspepsia, loss of appetite, and hepatic torpor. As a *diuretic* it has been employed with some benefit in dropsy.⁶ As a *febrifuge* in intermittents, it has been employed either alone or in conjunction with cinchona.⁷ But the principal use of mustard is as a *rubefacient* (see *Cataplasma Sinapis*). Flour of mustard, or bruised mustard seed, is sometimes added to pediluvia.

ADMINISTRATION.—As an *emetic*, the dose is from a teaspoonful to a table-spoonful of the flour of mustard in a tumblerful of water. As a *diuretic* in dropsies, and for some other purposes, *mustard whey* (*serum lactis sinapinum*) is a convenient form of exhibition. It is prepared by boiling half an ounce of the bruised seeds or powder in a pint of milk, and straining; the dose is fʒiv twice or thrice a day.

¹ This constitution differs from that formerly given by Dumas and Pelouze, *Journ. de Chim. Méd.* ix. 615.

² Robiquet and Bussy, *Journ. de Pharm.* xxvi. 119. ³ Julia Fontenelle, *Journ. de Chim. Méd.* i. 131.

⁴ Fontenelle, *op. supra cit.* 131.

⁵ On the use of mustard emetics in cholera, see *Lond. Med. Gaz.* ix. 519, 592, and 795.

⁶ Mead, *Works*, p. 514, 1702.

⁷ Bergius, *Mat. Méd.* 2d edit. ii. 618.

CATAPLASMA SINAPIS, L.; *Sinapismus*; *Mustard Poultice* or *Sinapism*.—(Linseed; Mustard seed, of each, powdered, ℥iiss; Boiling Water ℥xj. Add the powders, previously mixed, to the water by degrees, stirring so that a poultice be made.)—Crumb of bread may be often conveniently substituted for linseed meal. Vinegar and other acids check the formation of the acrid oil. Boiling water also has an injurious effect. Hence water whose temperature does not exceed 100° F. is to be preferred for making the mustard poultice. Aetius¹ was acquainted with the injurious influence exercised by vinegar on mustard; and he observes: "*Sed et hoc noscendum est: si in aceto maceretur sinapi inefficatus redditur: Acetum enim sinapis vim discutit.*" Several experiments on this subject have been made by Trousseau and Pidoux.² They found that a sinapism made with flour of black mustard and water produced as much effect in six minutes as one made with flour of black mustard and vinegar did in fifty. Curiously enough, however, they state that vinegar did not diminish the activity of English flour of mustard. This, perhaps, is referable to the fact that common English flour of mustard contains pod-pepper, the active principle (*capsicin*) of which is soluble in vinegar. The London College formerly ordered vinegar.—The mustard cataplasm is a powerful local irritant. It readily excites inflammation, and, when allowed to remain applied sufficiently long, causes vesication. It proves, in many cases, a most painful application. In various affections of the brain (as in the stupor and delirium of low fever, in apoplexy, and in poisoning by opium) it is a most valuable application to the feet and ankles. In pulmonary and cardiac diseases it is occasionally applied to the chest with excellent effects. Dr. Blackall³ speaks in high terms of the mustard cataplasm, quickened with oil of turpentine, in typhoid pneumonia. Of course, in all these cases, it operates on the principle of a blister, over which its speedy effect gives it a great advantage. It is applied spread on linen or calico. Great caution is necessary in its application to persons who are insensible to pain; for if it be continued too long, it may occasion ulceration and sloughing, though no pain be manifested. Hence its effects should be examined at short intervals. In one case, death had nearly resulted from the neglect of this caution. Four sinapisms were applied to the wrists and insteps of a female lying in a comatose condition following puerperal convulsions. As no manifestation of pain occurred, the application was continued for three hours. Sloughing followed, which nearly proved fatal.⁴

335. SINAPIS ALBA, Linn. L. E. D.—WHITE MUSTARD.

Sex. Syst. Tetradynamia, Siliquosa.

(Semen, L.—Semina, D.—Flour of the seeds of *Sinapis nigra*, generally mixed with those of *Sinapis alba*, and deprived of fixed oil by expression, E.)

BOTANY. *Gen. Char.*—See *Sinapis nigra*.

Sp. Char.—*Siliques* hispid, spreading, somewhat narrower than the ensiform beak. *Leaves* lyrate, and, as well as the *stem*, nearly smooth. (De Cand.)

Annual. *Stem* 1 or 1½ foot high. *Flowers* large, yellow. *Beak* longer than the pod.

Hab.—Indigenous; in waste places. Cultivated in both fields and gardens. Flowers in June.

DESCRIPTION.—White mustard seeds (*semina sinapis albae*) are larger and somewhat less acrid to the taste than the black ones. They consist of rounded-elliptical yellow grains, composed of a yellow nucleus enveloped in a thin semitransparent shell. The hilum is at one extremity of the ellipse.

COMPOSITION.—According to the analysis of John,⁵ white mustard seeds consist of an *acrid volatile oil*, *yellow fatty oil*, *brown mild resin*, *extractive* (very small

¹ *Synops.* iii. cap. 181.

² *Observ. on Dropsies*, 4th edit. p. 339, 1824.

³ *Guélin, Handb. de Chem.* ii. 1247.

⁴ *Traité de Thérap.* i. 692.

⁵ Trousseau and Pidoux, *op. supra cit.* i. 769.

quantity), *gum* (small quantity), *woody fibre*, *albumen*, *free phosphoric acid*, and *salts*.

Robiquet and Boutron,¹ however, have proved that white mustard contains neither volatile oil nor any substance capable of producing it; and that it owes its activity to a *non-volatile acrid substance*, which does not pre-exist in the seeds, but is readily formed in them under certain conditions. Another chemical peculiarity of white mustard seed is, that it contains *sulpho-sinapisin*.² Hence, while sesquichloride of iron strikes a deep red colour in an infusion of white mustard, it merely communicates an orange tint to the infusion of black mustard. Moreover, the thick mucilaginous liquor obtained by digesting the seeds of white mustard in cold water is peculiar to them.³ Simon⁴ has announced the existence of a new principle, which he calls *erucin*.

1. **SULPHOSINAPISIN**.—It was at first supposed to be an acid, and was in consequence called, by Henry and Garot,⁵ *sulphosinapic acid*. But they subsequently established its non-acid properties. It is a white, crystallizable, odourless, bitter substance, soluble in water, alcohol, and ether. Under the influence of various agents (acids, oxides, and salts) it readily yields hydrosulphocyanic acid. To this acid is probably to be ascribed the red colour developed when a persalt of iron is added to an aqueous infusion of white mustard. Its aqueous solution forms, with nitrate of silver, a white precipitate. Boutron and Frémy state that sinapisin [sulphosinapisin], under the influence of emulsion [myrosine], is converted into an acrid substance and hydrosulphocyanic acid. Sulphosinapisin consists of *carbon* 57.920, *hydrogen* 7.795, *nitrogen* 4.940, *sulphur* 9.657, and *oxygen* 19.688; or $C^{24}H^{22}NS^2O^7$. [This statement of its composition requires revision.—En.]

2. **NON-VOLATILE ACRID PRINCIPLE**.—This does not pre-exist in white mustard, but is readily developed in it by cold water. As before mentioned, Boutron and Frémy⁶ ascribe its formation to the action of the emulsion of the seed on the sulphosinapisin, by which hydrosulphocyanic acid and this acrid matter are produced. The latter substance is an unctuous, reddish, odourless liquid, which has the pungent hot taste of horseradish. It contains sulphur as one of its constituents.

[From recent researches it appears that myrosine is contained both in black and white mustard; it is found to be precisely similar, and to possess similar properties, in the two varieties of seeds; but the products are different. Thus white mustard does not yield with myrosine and water the volatile oil of mustard, but a pungent oil of a different kind; hence it may be inferred that white mustard does not contain myronate of potash, but some other substance of an analogous kind. This different result on the two seeds is not owing to any peculiarity in the myrosine of white mustard, because when this is added to the residue of black mustard deprived of its myrosine, it yields the volatile oil, just as the emulsine of the sweet almond produces the essential oil of almonds on mixture with the amygdaline of the bitter almond and water. Myrosine acts on amygdaline like emulsine, but the latter cannot develop volatile oil of mustard by its action on myronate of potash.—En.]

3. **ERUCIN**.—A yellowish-white substance, which is very soluble in ether, carburet of sulphur, and turpentine. It dissolves in boiling alcohol, but is insoluble in water and solution of ammonia. It does not redden the salts of iron, and contains no sulphur.

PHYSIOLOGICAL EFFECTS.—Similar to, though milder than, those produced by black mustard. Swallowed whole, the seeds prove stomachic, laxative, and diuretic. But their use in the large quantities in which they have been recommended is by no means free from danger. Gastro-enteritic inflammation of a fatal kind has been induced by them. The danger of their accumulation in the appendix cæci is obvious. Mr. J. L. Wheeler⁷ has known them retained in the bowels for seven weeks.

USES.—Dr. Cullen⁸ first mentions the practice of giving half an ounce, or an ordinary tablespoonful, of entire and unbruised mustard seeds. A few years ago, it was again brought forward, as if new.⁹ It has been advocated in a long list of diseases attended with torpor or atony of the digestive organs; and at one time it was fashionable and popular. Sir John Sinclair¹⁰ recommended mustard seeds for the preservation of the health of old people especially. The seed-leaves of white mustard and of *Lepidium sativum* are used at table under the name of *mustard* and *cress* or *corn salad*.

¹ *Journ. de Pharm.* xvii. p. 279.

² Cadet, *Journ. de Pharm.* xiii. 191.

³ *Journ. de Chim. Méd.* i. 439.

⁴ *Cat. Rat. Plant. Med.* Lond. 1830.

⁵ C. T. Cooke, *Obs. on the Efficacy of White Mustard Seed*, 3d ed. 1826.

⁶ *Lancet*, Jan. 25, 1834, p. 669.

⁷ Henry and Garot, *Journ. de Chim. Méd.* i. 441.

⁸ *Journ. de Pharm.* xxv. 370.

⁹ *Journ. de Pharm.* xxvi. 50.

¹⁰ *Mat. Med.* ii. 171.

ADMINISTRATION.—From two or three large teaspoonfuls to a tablespoonful of the whole unbruised seed have been recommended to be swallowed three or four times daily.

ORDER LXXXV. PAPAVERACEÆ, *Jussieu*.—THE POPPY TRIBE.

CHARACTERS.—*Sepals* 2, deciduous. *Petals* hypogynous, either 4, or some multiple of that number, placed in a cruciate manner. *Stamens* hypogynous, either 8, or some multiple of 4, generally very numerous, often in four parcels, one of which adheres to the base of each petal; *anthers* 2-celled innate. *Ovary* solitary; *style* short or none, *stigmas* alternate with the placenta, 2 or many; in the latter case stellate upon the flat apex of the ovary. *Fruit* 1-celled, either pod-shaped, with two parietal placenta, or capsular, with several placenta. *Seeds* numerous; *albumen* between fleshy and oily; *embryo* minute, straight at the base of the albumen, with plano-convex *cotyledons*.—*Herbaceous* plants or *shrubs*, with a milky juice. *Leaves* alternate, more or less divided. *Peduncles* long, 1-flowered; *flowers* never blue (Lindley).

Fig. 405.



Capsule of the Poppy.

PROPERTIES.—The plants of this order possess narcotic and acrid properties. At the head of the narcotic papaveraceæ stands the genus *Papaver*, from which opium is procured. The acrid papaveraceæ usually possess narcotic properties also. *Sanguinaria canadensis* is one of the best known acro-narcotics of this order.¹ In doses of from ten to twenty grains it operates as an emetic. In larger doses it causes depression of pulse, faintness, dimness of vision, and alarming prostration of strength. Its active principle is an alkali called *sanguinarina*. *Chelidonium majus* is another acrid of this order

336. PAPAVER RHEAS, *Linn. L. E. D.*—COMMON RED CORN POPPY.

Sex. Syst. Polyandria, Monogynia.

(*Petalum* recens, *L.*—*Petals*, *E. D.*)

HISTORY.—Theophrastus² calls the red poppy *ροῖα*. Dr. Sibthorp³ considers the *μαῶν ροῖα* of Dioscorides⁴ to be the red poppy.

BOTANY. *Gen. Char.*—*Sepals* 2, convex, deciduous. *Petals* 4. *Stamens* numerous. *Style* 0. *Stigmas* 4 to 20, radiating, sessile upon the disk crowning the ovary. *Capsule* obovate, 1-celled, composed of from 4 to 20 carpels inclosed in a membranous production of the thalamus, dehiscing by short valves under the crown of the stigmas. *Placenta* between the valves, produced internally, forming complete dissepiments. (*De Cand.*)—*Herbs*, with a white juice. *Peduncles* inflexed at the apex before flowering.

Sp. Char.—*Capsule* smooth, obovate. *Sepals* hairy. *Stem* many-flowered, rough, with spreading setæ. *Leaves* pinnatifid; lobes elongated, incised-dentate, acute. (*De Cand.*)

Annual. *Petals* rich scarlet. This plant is distinguished from *Papaver dubium* by, 1st, the wide-spreading hairs of the flower-stalks; 2dly, a shorter capsule; 3dly, its stigma of eight to ten rays.

Hab.—Indigenous. A troublesome weed common in fields. Flowers in June or July.

DESCRIPTION.—The petals of the red poppy (*petala rhœados seu papaveris erratici*) have a rich scarlet colour, a slightly opiate odour, and a bitterish taste. By drying they become violet red and odourless.

¹ Bird, *An Inaug. Dissert. on Sang. canad.* New York, 1822.

² *Prod. Fl. Græc.* i. 359.

² *Hist. Plant.* ix. 13.

⁴ *Lib.* iv. cap. 64.

COMPOSITION.—The flowers of the red poppy have been analyzed by Beetz and Ludewig,¹ and by Riffard.² The latter chemist obtained *yellow fatty matter* 12, *red-coloured matter* 40, *gum* 20, *lignin* 28. It is not improbable that this plant may contain *morphia* in very minute quantity.

RED COLOURING MATTER.—Riffard obtained it, in the impure state, by first macerating the petals in ether to remove a fatty matter, and then in alcohol. By distilling the alcoholic tincture to dryness, a dark-red colouring matter was obtained, which in thin layers was bright red. It was deliquescent in the air, soluble in alcohol and in water, but insoluble in ether. Acids diminished the intensity of its colour. Chlorine decolorized it. The alkalis blackened it. By the last character it is distinguished from the colouring matter of the red cabbage, &c., which becomes green by alkalis. Sesquichloride of iron gives it a dark violet or brown tinge.

PHYSIOLOGICAL EFFECTS AND USES.—The red poppy is valued medicinally as a colouring ingredient only. It probably possesses a narcotic property in a very slight degree, but which is scarcely sensible in the ordinary doses in which this medicine is employed. Navier³ says that the continued use of the tincture or syrup by dogs gave the stomach a bluish-red tinge.

5. **SYRUPUS RHÆADOS, L. E. ; Syrup of Red Poppies ; Syrup of Corn Poppy.**—(Of the Red Poppy ℥ij ; Boiling Distilled Water Oj ; Sugar ℥iij, or a sufficiency ; Rectified Spirit ℥iiss, or a sufficiency. Add the red poppy gradually to the water heated in a water-bath [vapour-bath, *E.*], frequently stirring them ; then the vessels being removed, macerate for twelve hours ; afterwards [strain and, *E.*] express the liquor by hand [through calico, *E.*], and [proceed as ordered for the Syrupus Althææ, *L.*] [add the sugar, and dissolve with the aid of heat, *E.*]—Employed only as a colouring ingredient, especially in conjunction with acids, which brighten it. It readily ferments and spoils.

387. PAPAVER SOMNIFERUM, Linn. L. E. D.—THE SOMNIFEROUS OR WHITE POPPY.

Sex. Syst. Polyandria, Monogynia.

(Capsulæ maturæ ; Capsulæ immaturæ succus coneretus, *L.*—Capsules not quite ripe ; Concrete juice from the unripe capsules, *E.*—Capsularum succus proprius coneretus ; Capsulæ maturæ, *D.*)

HISTORY.—This is one of the most anciently known and described plants. Homer speaks of the *poppy* (μῆκων) growing in gardens ;⁴ so that it appears to have been in cultivation even at that early period. It was employed in medicine by Hippocrates, and is mentioned by Theophrastus, Dioscorides, and Pliny. Hippocrates⁵ speaks of two kinds, the *black* and *white poppy* ; the former, he says, confines the bowels more than the latter.

It is uncertain at what period *opium* was first known or introduced into medicine. Hippocrates⁶ recommends the μῆκωνιον, or *poppy juice*, in a disease of the uterus ; and Dioscorides,⁷ on the authority of Erasistratus, tells us that Diagoras (who was contemporary, as is supposed, with Hippocrates) condemned the use of opium. These are, I believe, the most ancient Greek authorities who speak of this substance ; and it is impossible, I think, to arrive at any accurate conclusion from their remarks, whether opium had or had not been known long before their time, though Alston⁸ infers, from the little use made of it by Hippocrates, as well as from Diagoras condemning its use in diseases of the eyes, that its virtues were not known long before him. Dioscorides and Pliny⁹ mention that the expressed juice of the heads and leaves is termed *Meconium*, and that it is much weaker than opium. Theodore Zwinger, Sprengel,¹⁰ and others, have supposed that the *nepenthes* (νηπενθής) of Homer¹¹ was opium. Dr. Royle,¹² however, has suggested that the substance referred

¹ Gmelin, *Handb. d. Chem.* ii. 1246.

² Wilmier, *Wirk. d. Arzneim. u. Gifte*, Bd. iv. S. 47.

³ *De vict. rat. lib. ii.* p. 357, ed. Fœss.

⁴ *Lib. iv.* cap. 65.

⁵ *Hist. Nat. lib. xx.* cap. 76, ed. Vulp.

⁶ *Od.* iv. 220.

⁷ *Journ. de Pharm.* xii. 412.

⁸ *Il.* viii. 306.

⁹ *De Morb. Mul.* lib. ii. p. 670.

¹⁰ *Lect. on the Mat. Med.* ii. 456.

¹¹ *Hist. Rei Herb.* i. 25.

¹² *Illustr.* p. 331.

to by Homer may have been a preparation of *Cannabis sativa*, the remarkable effects of which have been recently pointed out by Dr. O'Shaughnessy.¹

The word *opium* is derived from ὀπός, *the juice*, and signifies that it is *the juice* par excellence; just as the flower of the rosemary has been called *anthos*, or *the flower*, and the cortex cinchonæ, *the bark*.

BOTANY. Gen. Char.—See *Papaver Rhœas*.

Sp. Char.—*Capsules* obovate or globose, and, as well as the *calyces*, smooth. *Stem* smooth, glaucous. *Leaves* amplexicaul, cut-repand, dentate, somewhat obtuse. (De Cand.)

An annual herb. *Root* white, tapering. *Stem* 2 to 6 feet high, erect, branched, leafy, glaucous green. *Leaves* alternate, sessile, ovate-oblong, glaucous beneath. *Peduncles* terminal, leafless, with bristly hairs. *Seeds* numerous, small, roundish or reniform, oily, sweet, and edible.

There are two well-marked varieties, which, by some botanists, are considered to be distinct species:—

α. nigrum; *P. somniferum*, Gmelin.—*Capsules* globose, opening by foramina under the stigma. *Seeds* black.² *Peduncles* many. *Flowers* usually violet or red, of different tints, though sometimes white.

β. album; *P. officinale*, Gmelin.—*Capsules* ovate globose; foramina under the stigma either none or obliterated. *Peduncles* solitary. *Seeds* and *petals* white.

Hab.—Asia and Egypt. Grows apparently wild in some parts of England, but has probably escaped from gardens. Cultivated in Hindostan, Persia, Asia Minor, and Egypt, on account of the opium obtained from it. According to Dr. Royle, var. *β album* is cultivated in the plains of India; and var. *α nigrum* in the Himalayas. In Europe, the poppy is cultivated for the capsules, either as medicinal agents or for the oil (*poppy oil*) obtained from the seeds, and which is employed in painting. The London market is principally supplied with poppy heads from the neighbourhood of Mitcham, in Surrey.

DESCRIPTION. 1. OF POPPY HEADS.—Poppy heads (*Capsulæ seu Capita Papaveris*) are usually collected when quite ripe, as ordered by the London and Dublin Colleges; but they would be more active as medicinal agents if they were gathered while still green; and the Edinburgh College very properly directs the immature capsule to be employed. As met with in commerce, poppy heads vary somewhat in size from that of a hen's egg to that of the fist. Their texture is papyraceous; on the top of them is the star-like stigma. They are yellowish or yellowish-brown, and, if they have been collected before they were quite ripe, have a bitterish taste. When fresh, they have a slightly opiate odour, which they lose by drying. A decoction of the dried poppy capsule is rendered, by the sesquichloride of iron, brownish-red (*meconate of iron*). Nitric acid makes the decoction transparent, and communicates a slightly orange-red tinge, indicative of the presence of morphia.

2. OPIUM. Preparation.—The mode of extracting opium is, to a certain extent, similar in all countries, and consists in making incisions into the half-ripe poppy capsules, and collecting the exuded juice. According to Dioscorides,³ Kæmper,⁴ Kerr,⁵ and Texier, this juice is worked up into a homogeneous mass; whereas Bellonius⁶ and Olivier⁷ speak of the juice concreting on the poppy; and the first of these writers describes opium as consisting of agglomerated granules.

Now Guibourt,⁸ by examining the opiums of commerce by means of a magnifier, thinks he has discovered that the Smyrna and Persian (or Trebizond) opium is composed of small agglutinated tears (*opium with a grain*); whereas the Egyptian, and I would add the Indian opium, is a homogeneous mass, and therefore must have been worked up in the manner described by Dioscorides, Kæmp-

¹ On the Prepar. of the Indian Hemp, Calcutta, 1839.

² [*Mean seed* is the seed of a variety of garden poppy (*Papaver somniferum*) of a grayish-blue colour. It is eagerly eaten by birds, and is used as a medicine for them.—Ed.]

³ Lib. iv. cap. 61.

⁴ Med. Obs. and Inq. vol. v. p. 317.

⁵ Voy. dans l'Empire Ottoman.

⁶ Amœn. Exot. p. 613.

⁷ Observ. lib. iii. cap. 15.

⁸ Hist. abrég. ii. 3me éd. 1836.

fer, and others (*homogeneous opium*). M. Ch. Texier¹ thus describes the process of obtaining opium followed in Asia Minor: "A few days after the flower has fallen, men and women repair to the fields and cut the head of the poppy horizontally, taking care that the incisions do not penetrate the internal cavity of the shell. A white substance immediately flows out, and collects in tears on the edges of the cuts. In this state the field is left for twenty-four hours, and on the following day the opium is collected by large blunt knives. Each head furnishes opium once only, and that to an extent of a few grains. The first sophistication which it receives is that practised by the peasants who collect it, and who lightly scrape the epidermis from the shell to augment the weight. This operation adds about one-twelfth of foreign matters. Thus collected, opium has the form of a glutinous and granular jelly. It is deposited in small earthen vessels, and beat up with saliva. When asked why water was not employed in place of saliva, the answer was that water caused it to spoil. It is afterwards enveloped in dry leaves, and in this state it is sold. The seeds of those poppies which have yielded opium are equally good for sowing the following year."

Some little variation will be found in the description of other writers of the methods practised in other parts of the East. Kämpfer says that in Persia the incisions are made crosswise by a five-edged knife. Kerr states that, in the province of Behar, "two longitudinal double incisions" are made "upon each half-ripe capsule, passing from below upwards; care being taken that the internal cavity of the capsule is not penetrated.

[The most complete history of the cultivation and preparation of opium in our Indian possessions has been published by Dr. Eatwell. An abstract of his paper was published in the eleventh and twelfth volumes of the *Pharmaceutical Journal*, in 1852. We have selected from this such portions as appeared to possess any interest in reference to the history of this most important article of *Materia Medica*.—ED.]

The cultivation of the poppy in British India is confined to the large central Gangetic tract, about six hundred miles in length and two hundred miles in depth, which is bounded on the north by Goruckpore, on the south by Hazareebaugh, on the east by Dingepore, and on the west by Agra. This large extent of country is divided into two agencies, the Behar and the Benares, the former being presided over by an agent stationed at Patna, at which station is the central or sudder factory of the agency, the latter being under the control of an agent residing at Ghazeepore, which station contains the sudder factory of the Benares agency. Finally, the control of the entire department is vested in the Board of Customs, Salt, and Opium, located at Calcutta. Of the two agencies, the Behar is the larger and more important, sending to the market about treble the quantity of drug turned out by the Benares agency. The Benares agency comprises eight divisions, namely, the Benares and Mirzapore, the Ghazeepore, the Azinghur, the Juanpore, the Selimpore, the Goruckpore, the Cawnpore, and the Futtehpore. In these eight divisions, the aggregate amount of land under poppy cultivation, in the season 1849-50, was 107,823 beegahs.²

The lands selected for poppy cultivation are generally situated in the vicinity of villages where the facilities for manuring and irrigation are greatest. In such situations, and when the soil is rich, it is frequently the practice with the cultivators to take a crop of Indian corn, maize, or vegetables off the ground during the rainy season, and after the removal of this, in September, to dress and manure the ground for the subsequent poppy sowings. In other situations, however, and when the soil is not rich, the poppy crop is the only one taken off the ground during the year, and from the commencement of the rains in June or July until October, the ground is dressed and cleaned by successive ploughings and weeding, and manured to the extent which the means of the cultivator will permit. In the final preparation of the land in October and November, the soil, after being well loosened and turned up by the plough, is crushed and broken down by the passage of a heavy log of wood over its surface, and it is in this state ready for sowing. The amount of produce from various lands differs considerably. Under very favourable circumstances of soil and season as much as 12 or even 13 seers (26 lbs.) of standard opium may be obtained from each beegah of 27,225 square feet. Under less favourable conditions the out-turn may not exceed three or four seers, but the usual amount of produce varies from 6 to 8 seers per beegah.

The chemical examination of different soils in connection with their opium-producing powers

¹ *Journ. de Pharm.* xxi. 196.

² A Beegah is 27,225 square feet.

presents a field for very profitable and interesting inquiry; nor is the least important part of the investigation that which has reference to the variations in the proportions of the alkaloids (especially the morphia and narcotine) which occur in opium produced in various localities. That atmospheric causes exert a certain influence in determining these variations is probable; that they influence the amount of produce, and cause alterations in the physical appearance of the drug are facts well known to every cultivator. Thus, the effect of dews is to facilitate the flow of the juice from the wounded capsule, rendering it abundant in quantity, but causing it at the same time to be dark and liquid. An easterly wind (which in this part of the country is always concomitant with a damp state of atmosphere) retards the flow of the juice, and renders it dark and liquid. A moderate westerly wind, with dew at night, form the atmospheric conditions most favourable for collections, both as regards the quantity and the quality of the exudation. If, however, the westerly wind (which is an extremely dry wind) blow violently, the exudation from the capsules is sparing. Whilst the effects of the meteorological phenomena in producing the above results are well marked, their action in altering the relative proportions of the chemical constituents of the juice of the poppy plant is more obscure; and it is highly probable that the chemical composition of the soil plays a most important part in this respect. Dr. O'Shaughnessy is certainly the most accomplished chemist who has ever in India turned his attention to the subject, and he has published the results of his analysis of specimens of opium from the different divisions of the Behar agency, which are worthy of much attention. In the opium from eight divisions of the agency, he found the quantity of morphia to range from $1\frac{3}{4}$ to $3\frac{1}{2}$ grains per cent., and the amount of the narcotine to vary from $\frac{3}{4}$ grain to $3\frac{1}{2}$ grains per cent., the consistence of the various specimens being between 75 and 79 per cent. In the opium from the Hazareebaugh district (the consistence of the drug being 77) he found $4\frac{1}{2}$ per cent. of morphia and 4 per cent. of narcotine, whilst from a specimen of Patna garden opium he extracted no less than $10\frac{3}{4}$ per cent. of morphia and 6 per cent. of narcotine, the consistence of the drug being 87. With respect to this last specimen, Dr. O'Shaughnessy mentions that the poppies which produced it were irrigated three times during the season, and that no manure was employed upon the soil. It is much to be regretted that these interesting results were not coupled with an analysis of the soils from which the specimens were produced, for to chemical variations in it must be attributed the widely different results recorded above. The climate in which the Patna garden opium was produced (and which is equal in narcotic excellence to the best opium of Turkey or Egypt) was precisely the same as that in which the comparatively poor specimens of the eight divisions above alluded to were collected, and therefore could not have exerted any influence in producing the chemical differences which the drug from the different localities presented.

The poppy cultivated in the Benares and Behar agencies is exclusively the white variety (*papaver somniferum album*). In situations favourable to its growth, it vegetates luxuriantly, attaining usually a height of about four feet. The stem is branched, and is terminated by from two to five ovate-globose capsules, averaging in size a duck's egg. The plant takes about three months and a half in reaching maturity, and the time for its cultivation is exclusively the cold season, extending from November to March. It has been found advantageous to change the seed employed in the different divisions every two or three years, and there are certain districts which produce seed of generally acknowledged superiority, and from which the supplies are therefore drawn, and distributed to the cultivators of distant agencies. The soil having been prepared in the manner described above, the sowing is effected by throwing the seed broadcast over the land, and this takes place between the 1st and 15th of November. In three or four days, the plough is again passed over the land to bury the seed; and the soil is afterwards again levelled by means of the log of wood before alluded to. The whole surface is then divided into square compartments, the sides of which are about ten feet in length, and are raised and converted into little channels for the purpose of irrigation. The number of times the plant may require irrigation depends in a great measure upon the nature of the season; if some heavy showers fall in December, January, and February, two irrigations may be sufficient; whereas, if the cold season pass over with little or no rain, the operation may be required to be repeated five or six times. Ten or twelve days are sufficient for the germination of the seed, and after the little plants have attained a height of two or three inches they are carefully weeded and thinned.

In its progress towards maturity, the poppy plant is liable to injury in various ways. It may be nipped by unusually severe frosts, or the plant may become stunted and never fairly reach maturity, owing to the first sowings failing and subsequent late ones being required, or owing to unusual heat and deficient moisture. Portions of cultivation sometimes droop and wither from causes which are not obvious, or are attacked by blight; and finally, considerable injury is frequently inflicted upon the poppy plants by a parasitical species of broom rape (the *Orobanche indica*), which, attaching itself to the roots of the plants, causes them to wither. In February, the plant is generally in full flower, and towards the middle of the month, and just before the time for the fall of the petals, these latter are all carefully stripped off and collected. They are then formed into circular cakes from ten to fourteen inches in diameter, and about $\frac{1}{16}$ of an inch in thickness. The manner in which these leaf-cakes are formed is the following: A circular shallow earthen vessel is heated to the requisite degree, by being placed inverted

over a slow fire. A few petals are then spread upon its heated convex surface, and as soon as the glutinous juice which they contain is seen to exude, others are added to the moist surface and are pressed down by means of a cloth. As soon as these latter become moist in turn, they receive a similar addition of petals, and in this manner the cake is extended circularly by successive and continuous additions, until it has reached the required dimensions. Instead of the earthen vessel, a shallow or nearly flat iron cooking utensil is sometimes used. The cakes of petals (known in the department under the name of "leaves"), when they reach the sudder factory at Ghazeepore, are carefully sorted and separated into three classes, according to their size and colour. The smaller and dark-coloured "leaves" are used in forming the inner portions of the shells of the opium cakes, whilst the largest and least discoloured ones are kept for furnishing their outside coverings. In a few days after the removal of the petals, the capsules have reached their utmost state of development, when the process of collection commences, which extends from about the 20th of February to the 25th of March.

The mode of collecting the juice is the following: At about three or four o'clock in the afternoon, individuals repair to the fields and scarify the poppy capsules with sharp iron instruments called nushturs. The nushtur consists of four narrow bars of iron, each of which is about six inches in length, and of about the thickness of the blade of a penknife. At one extremity, each bar does not exceed a quarter of an inch in breadth; but it gradually expands, until it has acquired the breadth of about one inch at the opposite end, where it is deeply notched. The sides of the notch are somewhat curved and ground to sharp edges, and the external angles are brought to sharp points. The four little bars, being placed side by side, are bound firmly together by means of strong cotton thread; and the points, at their cutting extremities, are kept separated from each other, to the extent of about $\frac{1}{16}$ of an inch, by means of the cotton thread which is passed between each pair of contiguous blades. Thus prepared, the instrument presents four pairs of curved, pointed, diverging blades, somewhat similar in shape to the lancet blades of a cupping scarificator. In employing the nushtur, only one set of points is brought into use at a time, and the capsule is scarified longitudinally from its base to its summit, the incisions generally passing more or less along one of the longitudinal eminences, observable on the outside of the capsule, which mark the attachment of the internal dissepiments. The scarifications thus made are very superficial, and do no more than traverse the thin pericarp of the capsule. If a horizontal section be made of the capsule of a vegetating poppy plant, the milky juice will after a few seconds be perceived to exude first and in greatest quantity from those portions of the sarcocarp which correspond to the bases of the dissepiments. It does not, however, exude only from these points, but ultimately from the entire surface of the cut sarcocarp. It moreover does not appear in dots as if poured out from longitudinal vessels, but exudes gradually from the meshes of the cellular tissue. If a thin segment of the capsule be examined under a high magnifying power, no longitudinal vessels are observable, but a confused mass of cellular tissue is observed occupying the interspace between the epicarp and endocarp; and opposite to the duplicatures of the endocarp, which go to form the dissepiments, the meshes of the cellular tissue are perceived to be much larger than in other situations; hence the free exudation of juice at these points. It therefore appears that the mode of making the scarifications as actually practised is the most effectual that could be adopted. Each capsule is scarified from two to six times, according to its dimensions; an interval of either two or three days being allowed after each operation.

The capsules having been scarified in the manner above described, the collection of the juice is made at an early hour in the following morning. This is effected by means of instruments called sectooahs, which are made of sheet-iron, and resemble concave trowels; and with these the juice is scraped from the surface of the scarifications, until the instruments become filled, when their contents are emptied into an earthen pot which the collector carries by his side. After the plant has ceased to yield any more juice, its utility is still unexhausted. The capsules are then collected, and from the seeds an oil is extracted, which is used by the natives for domestic purposes, both for burning in lamps and for certain culinary purposes. Of the entire seed a comfit is made, resembling in appearance caraway comfits. Of the dry cake remaining after the extraction of the oil, a coarse description of unleavened bread is sometimes prepared by the very indigent, or it is given to cattle, or used medicinally for poultices. The capsules, deprived of their seeds, are still available for preparing emollient and anodyne decoctions, which the natives use both internally in coughs, and externally as fomentations. The stems and leaves are left standing, until they have become perfectly dry, under the influence of the hot winds of April and May, when they are removed, and crushed and broken up into a coarse powder, known, in the department, under the name of "poppy trash," and which is employed in packing the opium cakes. When fresh collected, the juice from the capsules presents the appearance of a wet granular mass, of a pinkish colour, and in the bottom of the vessel which contains it is found collected a dark fluid resembling infusion of coffee, to which the name of pussewah is given. The recent juice reddens strongly litmus paper, and acts rapidly upon metallic iron, covering it speedily with an inky crust of meconate of iron. The juice, when brought home by the cultivator, is placed in a shallow earthen vessel, which is tilted to such a degree that all the pussewah can drain off; and this plan is persevered in so long as anything fluid will separate. The pussewah obtained by this means is set aside in a

covered vessel, and receives no farther attention until taken for weighment to the Ghazee-pore sudder factory.

The opium now requires frequent attendance on the part of the cultivator. It is daily exposed to the air, though never to the sun, and is regularly turned over every few days, in order to insure a uniform dryage in the whole mass; and this process is persevered in for the space of three weeks or a month; or, in fact, until such time as the drug may have reached within a few degrees of standard consistence. Standard opium, according to the Benares regulations, is opium which, on being subjected to a temperature of 200° Fah., until everything volatile is driven off, shall leave a residue of 70 per cent. This is the consistence at which the agency puts up the drug for the market, every effort being made to adhere to it as strictly as possible, and this is likewise the standard by which the price paid to the cultivators is regulated. If the cultivator deliver his drug of standard consistence, he receives for it the regulated price; if it be above standard, he receives a pro rata increase of payment; whereas, if it be below standard, he is subjected to a corresponding deduction in price. The opium, on its arrival at the Ghazee-pore factory, is turned out of the confined earthen pots in which it is received, and is weighed in wide tin vessels called tagars, care being taken that no larger quantity than 10 seers (20 lbs.) is ever brought to the scale at a time. This weighment is made under the eye of the gomashtha (or of his accredited agent) of the kotee to which the opium belongs, and in the case of the neighbouring or "home" kotees, the cultivators attend in person with their produce. This weighment is verified by an European officer stationed at a check-scale in another room, and the tagar with its contents passes on at once to a table, at which are seated the opium examiner, or an experienced sub-deputy agent, and the native opium examiner, called the purkhea. The purkhea now plunges his hand into the centre and to the bottom of the drug, stirs it about, and grasps it in various directions to feel for impurities, and then withdraws a handful, which he manipulates between his fingers, revealing its colour, texture, and mode of fracture, and finally ascertains its aroma.

He then throws upon a plate a small portion as a specimen, and estimates its consistence. This estimate is written down on a ticket by the European officer, and it is sent with the specimen to the laboratory, where a fixed weight of drug is accurately weighed, evaporated to dryness in a plate placed on a metallic table heated by steam, and the weight of the residue carefully determined. It rarely happens that the purkhea's guess differs from the actual assay by more than one or two grains, and it serves to check the actual assay in cases of evident mistake or accident, which occasionally must occur when a multitude of delicate operations are rapidly carried on. The number of specimens which leave the examiner's table daily amounts to little short of two thousand. In the examination which the drug undergoes at this stage, the quantity or pussewah which it may contain is made the subject of special remark; and a pussewah fine or batta, as it is termed, is levied, proportionate to the quantity apparently present in the drug. The reason for this is, that pussewah injures the physical qualities of opium, causing it to look black and liquid, whilst at the same time it gives to the drug a high assay when tested by evaporation.

The *tactus eruditus* possessed by the purkhea is very remarkable; he rarely fails to detect even small quantities of the grosser and more tangible impurities, whilst he is no less delicately alive to the slightest variation in colour and smell. In the event of a specimen appearing to be adulterated, it is at once set aside to be carefully examined by the opium examiner, who makes a special report respecting it for the information of the agent, who, should he see sufficient grounds for doing so, confiscates it, when the whole of the drug is destroyed, and the cultivator gets nothing for it. Should the adulterations be less extensive, and the drug such as to be not altogether useless, it is taken at half price, or is subjected to such smaller penalty as the examining officer may think fit to inflict; and it is employed in making the lewah, or paste, used in forming the shells of the opium cakes. The great probability of detection, and the risk of confiscation, act as very efficient checks to the prevalence of adulteration, and the quantity of opium confiscated yearly is comparatively small. The nature of the adulterations practised by the cultivators is very various.

The grosser impurities usually mixed with the drug to increase its weight, are mud, sand, powdered charcoal, soot, cow-dung, pounded poppy petals, and pounded seeds of various descriptions. All of these substances are readily discoverable in breaking up the drug in cold water, removing the soluble and lighter portions of the diffused mass by decantation, and carefully examining the sediment. By this means impurities of the above nature usually become physically apparent. Flour is a very favourite article of adulteration, but is readily detected; opium so adulterated speedily becomes sour, it breaks with a peculiar short ragged fracture, the sharp edges of which are dull, and not pink and translucent as they should be; and, on squeezing a mass of the drug after immersion in water, the starch may be seen oozing from its surface. The application of the iodine test, however, furnishes conclusive evidence of its presence, or at least of that of some amylaceous compound. The farina of the boiled potato is not unfrequently made use of; ghee and goor (an impure treacle) are also occasionally used, as being articles at the command of most of the cultivators. Their presence is revealed by the peculiar odour and consistence which they impart to the drug. In addition to the above, a variety of vegetable juices, extracts, pulps, and colouring matters, are occasionally fraudulently mixed with

the opium; such are the inspissated juice of the common prickly pear (*Cactus dillenii*), the extracts prepared from the tobacco plant (*Nicotiana tabacum*), the *Datura stramonium*, and the Indian hemp (*Cannabis indica*), &c. The gummy exudations from various plants are frequently used; and of pulps, the most frequently employed are those of the tamarind and of the Bael fruit (aegle marmelos). To impart colour to the drug, various substances are employed, as catechu, turmeric, the pounded flowers of the mowla tree (*Bassia latifolia*), &c.

In the case of so complex a substance as opium, it is useless to look for a single test which shall reveal at once, with chemical precision, the purity of the drug; morphimetry would be the most accurate test to put in force, but the process would be too tedious and expensive to be of practical utility. Moreover, the colour, aroma, and texture are the commercial criterions of the excellence of the drug; and opium rich in morphia, but deficient in the above qualities from careless preparation, would probably be regarded with suspicion in the market, despite its intrinsic narcotic excellence; and for this reason, whenever the drug is received deficient in the above sensible qualities (as sometimes arises from careless treatment), but not adulterated in any way, it is subjected to a certain fine, and employed only in making lewah. The colour of well-prepared opium is a deep dull brown when viewed in mass, which becomes a bright chestnut brown when a small portion of drug is spread in a thin layer upon a white surface. It adheres to the fingers, and draws out to a moderate extent, breaking with a ragged fracture; should it, however, contain much pussehah, its ductility is much increased, and it is more glutinous.

Its smell is peculiar, and perfectly *sui generis*; it is not unpleasant, and in the recent well-prepared drug somewhat fruity. In cold water it breaks down readily into curdy flakes of the colour of pease soup, which gradually subside, leaving the supernatant liquid of a deep brownish-yellow colour. When broken under water by the hand, the drug adheres moderately to the fingers at first, but is soon entirely diffused. Should it contain gum fraudulently mixed, this latter adheres pertinaciously to the hands, and is with difficulty removed; and in this manner I have frequently detected the presence of a substance similar to birdlime, probably the tenacious juice of the banyan tree (*Ficus indica*). If to a portion of the cold watery infusion in a test-tube, a few drops of a solution of diacetate of lead be added, a dirty gray precipitate (meconate of lead) falls, so copious as to equal nearly in bulk the amount of fluid in the tube. Ammonia throws down a very similar and almost equally abundant precipitate, composed of resin and the alkaloids, which, on exposure to the air, speedily assumes a black colour. Tincture of iodine throws down a brick-red precipitate, and tincture of sesquichloride of iron occasions a similar precipitate of somewhat darker colour. These tests may be applied in a few seconds, and the comparative bulk of the precipitates thrown down may enable us to form a rude estimate of the amount of opium contained in a given specimen. In very largely adulterated specimens, the evidence afforded by the above means is sufficiently marked. A solution of gelatine for the detection of tannic acid, and strong alcohol for the precipitation of gum, form the only other chemical reagents likely to be required.

After having been duly weighed into store, the opium receives but little treatment in the factory. It is kept in large wooden boxes, capable of containing about 14 mds (10 cwt.) each, in which it is (if below the manufacturing standard) occasionally stirred up from the bottom, until it has acquired the necessary consistence. Whilst remaining in these boxes, it speedily becomes covered with a thin blackish crust (ulmine), and deepens in colour according to the amount of exposure to air and light which it undergoes. Should the drug be of very low consistence, it is placed in shallow wooden drawers, instead of in boxes, in which it is constantly turned over, until its consistence has approximated to 70 per cent. From the general store or malkhana, the drug is exported daily in quantities equalling about 250 maunds, for the purpose of being manufactured or made up into balls or *cakes*, as they are termed in the department.

In exporting opium for this purpose, the officer who performs the duty selects for the most part opium which is exactly at standard, or very close to it, whilst to compensate for any drug which may have risen higher than the prescribed consistence, a certain proportion of opium of low consistence is exported, the consistences of the various proportions of drugs selected for export being determined by a certain number of test assays. The portions of drug thus selected are then weighed out with exactitude, in portions of 10 seers (20 lbs.) each, and are thrown promiscuously into shallow wooden drawers, in which men mix them up together, rapidly and thoroughly thrusting their arms into the drug and kneading it in various directions. From these drawers the opium is transferred as mixed to boxes, all of which are of the same size, and from each of which a specimen is drawn and assayed. The mean of the assays of these boxes gives the average consistence of the export of the day, and serves as a guide as to whether the drug be of the proper consistence for caking. The above operations are generally completed by about 4 P.M., and before evening the drug is removed from the boxes to large wooden vats, 20 feet long, 3½ feet wide, and 1½ feet deep, situated in the caking-room. In these vats it undergoes a farther kneading and admixture, by men who wade knee-deep through the opium from one end of the vats to the other, until their contents appear to be of uniform consistence. Two specimens are, on the following morning, drawn from each vat, and assayed; and should the consistence have reached the factory standard, caking immediately commences.

Down either side of the room in which the vats are placed, are ranged the cake-makers, numbering usually about one hundred and ten individuals; each man being seated upon a wooden stand, and being furnished with a brass cup, forming the half of a hollow sphere, and with another tin vessel graduated so as to hold a determinate quantity of fluid. On the previous evening the leaves requisite for forming the shells of the cakes have been weighed out and tied up in bundles of prescribed weight, and have been damped to render them supple. Down the centre of the room are placed a certain number of small scales, at which the quantity of opium intended for each cake is separately weighed; and beside the scales are boxes filled with lewah, for the agglutination of the leaves which form the shells of the cakes. In forming the lewah, all opium of inferior quality is used, and all the pussewah received is also employed for this purpose; but in addition to these, a considerable quantity of unexceptionable drug is also expended. These are broken down in the washings of the various pots and vessels which have contained opium, and a thin semifluid paste is formed, of such a consistence that 100 grains of it, when evaporated to dryness at a temperature of 200° F., shall leave 53 grains of residue.

Matters being thus arranged, the cake-maker receives in his graduated measure from the lewah box the prescribed quantity of lewah for making a single cake, and having by his side a bundle of leaves previously weighed, he rapidly forms in his brass cup the lower segment of the shell of the opium cake, pasting leaf over leaf, until the thickness of half an inch has been obtained, and allowing a certain free portion of the most external leaves to hang down all round over the sides of the brass cup. This accomplished, a boy is in waiting with the opium to be put into the cake, which he has just brought from the caking scales, and which he throws into the shell so far prepared to receive it. The cake-maker, holding the opium away from the sides of the shell with the left hand, then tucks in round the sides leaf after leaf, well smeared with lewah, imbricating one over the other, until he has completed the entire circle; the free edges of the leaves, which had hitherto hung over the sides of the cup, are now drawn up tightly, and the opium well compressed within its bag of leaves.

A small portion at the top now only remains, which is speedily closed by laying on leaf after leaf; and finally the work is completed by the application of a single large leaf, which covers the entire exposed half of the cake. As thus formed, the well-finished cake is a pretty regular sphere, not unlike, in size and appearance, a 24 lb. shot. It is now rolled in a little finely-pounded poppy trash, which adheres to its surface, is at once placed in a small earthen cup, of precisely the same dimensions as the brass mould in which it was made, and is carried out into the open air and exposed to the direct influence of the sun. It is so exposed for three days, during which time it is frequently turned and examined; and if (as is frequently the case) it should have become distended and puffy, it is at once torn open, the extricated gas allowed to escape, and the cake again tightly closed. On the evening of the third day it is placed (still contained in its cup) in the cake-frames, which are formed of open battens, and allow of a free circulation of air about the cakes. The average number of cakes made by a single man in one day is about 70; but there are cake-makers who will turn out as many as 90 or 100 cakes, between 9 A. M. and 3 P. M. The number of cakes made daily in the factory, during the manufacturing season, is from 6,500 to 7,000, and the total number of cakes manufactured, in one season, has been 426,800.

By the end of July the manufacturing is finished, but the cakes still require much attention; they are constantly turned over in their cups, and as mildew collects on their surfaces, it is removed by rolling and rubbing them in dry poppy trash. They are, moreover, individually examined, and those which present weak points are strengthened by the application of extra leaves; and their appearance is moreover improved by the application of a single leaf of the first quality, which being of large dimensions, and carefully and equally made, covers the greater portion of the surface of the cake, and gives to it a smooth and finished appearance.

By October, the cakes have become perfectly dry to the touch, and have acquired considerable solidity; and they are now packed in chests, each of which is furnished with a double tier of wooden partitions, each tier presenting twenty square compartments, for the reception of so many cakes, and in which the cakes are steadied by means of loose poppy trash, with which all the interstices are filled.

It might be supposed that so fragile a structure as the poppy petal would furnish but an insecure packing envelop; but the shells of the opium cakes are possessed of more resistance than might be imagined, and owing apparently to some antiseptic property in the lewah, they are capable (after once being thoroughly dried) of being preserved for a great length of time. For three or four months after manufacture the shells require constant care and attention; and even after being packed, any exposure to damp or moisture subjects them to injury. After a certain lapse of time, however, the opium contained in the cake ceases to yield any more moisture to the shell, and this latter acquires extreme solidity. There are three specimen cakes in the Ghazee-pore factory which are some fifteen years old; they are as solid as balls of wood, and may be thrown from a height upon a stone floor without injury.

The above process of manufacture applies to the opium which is put up for the China market, and which includes the great bulk of the entire provision. With the drug intended for internal

consumption, and called abkaree opium, a different process is followed. The opium intended for abkaree purposes is brought to a consistence of 90 per cent. by direct exposure to the sun, in which state it is as firm and as easily moulded as wax. It is then formed, by means of a mould, into square bricks of one seer weight each, and these are wrapped in oiled Nepaul paper, and packed in boxes furnished with compartments for their reception. The opium put up in this way has not the same powerful aroma as is possessed by that put up in balls; but this is its only deficiency, whilst it has the great advantage of containing a large amount of drug in a very limited space, and in a state very manageable for packing.

The manufacture for the season being finally concluded, six cakes are selected promiscuously from the provision, by the magistrate of Ghazepore, for examination and chemical analysis. Of these, two are forwarded to the opium examiner at Calcutta, two to the examiner of the Behar agency, and two are reserved for examination by the examiner of the Benares agency.

The examination which these cakes undergo has reference to the following points:—

1. The gross weight of the cake.
2. The weight of the shell, detached as clearly as possible from the contained opium.
3. The weight of the opium contained in the shell.
4. The condition of the shell.
5. The physical character of the drug.
6. Its consistence.
7. The amount of extract taken up from it by cold distilled water.
8. The quantity of morphia present.
9. The quantity of narcotine present.

The following table will show the chemical results of the examination of the opium of the Benares agency from 1845 to 1849:—

Season.	Residue from 100 grs. exposed to a temp. 200° F.	Extract taken up by cold distilled water from 100 grs.	Morphia per cent.	Narcotine per cent.
1845—46.	73	52.33	2.76	5.33
	75	50.26	2.20	5.20
Average ..	74	51.29	2.48	5.26
1846—47.	72	43.25	2.46	4.30
	72	42.25	2.30	4.75
Average ..	72	42.75	2.38	4.52
1847—48.	71	44.43	2.23	5.66
	70	39.26	2.17	5.70
Average ..	70.5	41.84	2.20	5.68
1848—49.	75.5	47.37	2.75	3.85
	75.5	48.62	3.67	4.27
Average ..	75.5	47.99	3.21	4.06

A chief chemical feature which distinguishes Bengal opium from that of Turkey and Egypt, is the large proportion which the narcotine in the former bears to the morphia; and this proportion is shown by the above analysis to be constant in all seasons. It is a matter of importance to ascertain whether the treatment which the juice receives after its collection can influence in any way the amount of the alkaloids, or of the other principles contained in opium. In Turkey it is the custom to beat up the juice with saliva; in Malwa it is immersed, as collected, in linseed oil; whilst in Bengal it is brought to the required consistence by mere exposure to the air in the shade, though at the same time all the watery part of the juice that will separate is drained off and used, as has already been explained, in making lewah.

The following are the results which I obtained from the analysis of fresh juice, collected in February, 1850, and from which none of the pussewah was separated. The analyses have a special reference to the amount of the alkaloids, morphia, and narcotine, present in the drug, no attempts having been made to separate any of the other principles in a state of purity.

I.

Analysis of 2,000 grains of freshly collected juice, subjected to experiment in the day of collection.

	Grains.
Morphia	11.1
Narcotine	32.7
Other matters soluble in alcohol, codeia, narceia, meconic acid, resin, &c. &c.	521.0
Dry marc insoluble in alcohol, lignin, caoutchouc, &c. &c.	225.2
Water and volatile matter separable at a heat of 200° Fah.	1210.0
Total	2000.0

In the following experiment, the juice, instead of being subjected at once in its crude state to analysis, was exposed in an evaporating basin to a temperature of 200° F. until it was judged to have reached about the factory standard consistence; and of the opium so prepared, 1,000 grains were analyzed.

II.

	Grains.
Morphia	24.9
Narcotine	30.9
Other matters soluble in alcohol, codeia, narceia, meconic acid, resin, &c. &c.	546.7
Dry marc insoluble in alcohol, lignin, caoutchouc, &c. &c.	215.0
Water and volatile matter, separable at 200° Fah.	182.5
Total	1000.0

In Experiment III. a portion of freshly collected juice was placed in an open porcelain basin, on the 23d February, and occasionally stirred with a glass rod, until it had acquired solidity, no attempt being made to separate any pussewah from it. On the 7th May it was found to have acquired a consistence of 90.3 per cent. and its analysis gave the following results:—

	Grains.
Morphia	26.1
Narcotine	32.8
Other matters soluble in alcohol, codeia, narceia, meconic acid, resin, &c. &c.	630.4
Dry marc insoluble in alcohol, lignin, caoutchouc, &c. &c.	213.7
Water and volatile matter, separable at a heat of 200° Fah.	97.0
Total	1000.0

In order to be able to compare these results one with another, we will suppose, in each case, the drug to have been reduced to a similar state of dryness, by exposure to a heat of 200° F., when the composition of the three different specimens will appear as follows:—

	I.	II.	III.
Morphia	1.405	3.061	2.890
Narcotine	4.012	3.795	3.632
Matters soluble in alcohol	65.949	66.874	69.811
Dry marc insoluble in alcohol	28.506	26.301	23.665
Total	99.872	100.031	99.998

The agreement of the results in these three sets of experiments is tolerably close, except in the case of the drug subjected to analysis on the day of collection, in which the quantity of morphia present is extremely small; but, as if to compensate for the deficiency to a certain amount, the quantity of narcotine present is larger than in either of the other two specimens. The suggestion which this arrangement naturally prompts is, whether it be possible that narcotine, by parting with a portion of its carbon, hydrogen, and oxygen, during the process of analysis, or during the changes which occur in the juice after its extraction from the plant, can be converted into morphia. The proposition is, however, quite speculative, and could only be satisfactorily demonstrated by a careful set of minute experiments, having reference to the proportions of all the principles entering into the composition of opium, at different periods, from the date of the extraction of the juice until the cessation of all fermentative action, which takes place until the drug has reached a certain degree of spissitude. The results of the second analysis are worthy of remark; they seem to indicate that the employment of artificial heat in bringing the drug rapidly to the required consistence is not detrimental to the narcotic excellence of the resulting opium; on the contrary, the experiment, so far as it goes, appears to indicate the very opposite result. It has already been stated that in preparing the drug the cultivators drain from it all the fluid portion, which of course consists of the most soluble principles of opium, dissolved in dew, or in moisture absorbed from the atmosphere. I now propose alluding more particularly to this fluid, to which the name of *pussewah* is given, and which is brought to the factory in large quantities, of many gallons at a time, and of all consistences, from that of a limpid fluid to that of thick treacle.

Recently collected *pussewah* is a dark fluid, resembling strong infusion of coffee, and having a peculiar smell. It reddens litmus paper strongly; a solution of diacetate of lead causes in it a most copious gray precipitate (meconate of lead), and lime water has the same effect. Ammonia throws down a copious precipitate, of a mottled gray colour, which soon becomes uniformly black; and copious dilution with water likewise occasions in it a deep brown precipitate. I found the specific gravity of some recently-collected *pussewah* to be 1.120, the temperature of the atmosphere being 83°; and 100 grains, on evaporation to dryness, were found to yield 30 grains of a brownish-yellow residue, emitting an odour somewhat resembling that of heated Burgundy pitch. After *pussewah* has become concentrated to about one-third of its original volume, it acquires the consistence of treacle; and, as the process of drying goes on still farther, it gradually becomes solid. During the hot and dry months, this solid residue acquires a resinous hardness, becoming brittle, and breaking with a resinous fracture; but as soon as the weather becomes damp it rapidly absorbs moisture from the atmosphere, becomes jetty black and polished on the surface, and acquires a consistence similar to that of cobbler's wax. *Pussewah* (as might be supposed) contains some of the most valuable constituents of opium; its principal components are meconic acid, resin, morphia, and narcotine. From 500 grains of solid *pussewah*, which on evaporation to dryness left 88.9 grains of residue, I extracted 12 grains of pure narcotine, but only a trace of morphia. I, however, am inclined to attribute this latter result to an accident in the analysis; as in a second analysis of 500 grains of solid *pussewah*, which on evaporation yielded 85.5 grains of residue, I obtained 10.6 grains of morphia, and 16.9 grains of narcotine. In order to form an idea of the precise extent to which the composition of Bengal opium is affected by the practice of draining from it the *pussewah*, it is requisite to ascertain, with some approach to accuracy, the quantity of *pussewah* usually furnished by a given amount of opium. The quantity of standard opium received at the sudder factory of the Benares agency during the season of 1849-50, was 18,191 maunds; whilst the quantity of *pussewah* delivered amounted to 100 maunds, being at the rate of one maund of *pussewah* to nearly 182 maunds of drug, the *pussewah* containing, on an average, say 50 per cent. of solid matter. This *pussewah*, be it observed, although separated from the drug, is not lost to the provision, being employed in the formation of the shells of the cakes; and, as the Chinese form a watery extract of the drug for the purpose of smoking, the whole of the constituents of the *pussewah* are thus recovered on boiling the shells in water, as is practised in China.

Amongst the thousands of individuals, cultivators and employés, with whom the factory is filled during the receiving and manufacturing seasons, no complaints are ever heard of any injurious effects resulting from the influence of the drug, whilst they all remain quite as free from general sickness as persons unconnected with the general establishment; in fact, if anything, more so. It occasionally happens that a casual visitor to the factory complains of giddiness or headache; but the European officers employed in the department, who pass the greater part of the day with the thermometer between 95° and 105° Fah. amongst tons of the drug, never experience any bad effects from it. The native *purkhea* sits usually from 6 A. M. to 3 P. M. daily, with his hand and arm immersed nearly the whole time in the drug, which he is constantly smelling, and yet he feels no inconvenience from it. He has informed me that, at the commencement of the season, he experiences usually a sensation of numbness in the fingers; but I believe this to be more the result of fatigue, consequent upon the incessant use of the arm and fingers, than of any effect of the opium. In the large caking vats, men are employed to wade knee-deep through the drug for several hours during the morning, and they remain standing in it during the greater part of the rest of the day, serving out the opium by *armfuls*, their bodies being naked, with the exception of a cloth about the loins. These men complain of a sensation of drowsiness towards the end of their daily labours, and declare that they are overpowered early in the evening by sleep, but they do not complain of the effect as being either unpleasant or injurious. Infants, of a few months old, may be frequently seen lying on the opium-be-smear'd floor under the vats, in which dangerous position they are left by their thoughtless mothers, but, strange to say, without any accident ever occurring. Here are abundant facts to show that the health of those employed in the opium factory, and in the manipulation of the drug, is not exposed to any risk whatever, whilst the impunity with which the drug is handled by hundreds of individuals, for hours together, proves that it has no endermic action, for I am inclined to consider the soporific effect experienced by the vat-traders as produced through the lungs, and not through the skin.

[We subjoin the following remarks, by the late Dr. Pereira, on the cultivation and manufacture of *Patna Opium*, from a paper published by him in the *Pharmaceutical Journal* for Nov. 1851.—Ed.]

The India section of the Great Exhibition contained a most complete collection of specimens, drawings, and implements illustrative of the cultivation and manufac-

ture of Patna opium. Unfortunately, however, no description of the processes accompanied the illustrations, and therefore I have been obliged to obtain information on this subject from various sources. The drawings which were sent over were fifteen in number. Several of them, however, rather illustrated the general processes of agriculture followed in India, than anything peculiar to the cultivation of the poppy. The first of the series represented a native engaged in thinning and weeding the poppy plants. "The poppy," says Mr. W. B. Johnson, "requires a good, rich, dark soil, well prepared with manure, and divided into small oblong plots, of about six by four feet, for the convenience of weeding and patching. The sowings commence early in November. The day the seed is sown, the land is well watered; on the next day, the ryot breaks all the lumps with his *khoorpu*. The plant soon shoots up, and, when about six inches high, it is thinned and weeded; it is kept well watered until the capsules are nearly ripe, and the petals falling off. The watering then depends upon the state of the weather: if mild, the irrigation is continued; if there should be strong winds, it is discontinued, for fear of (the capsules?) being blown off." "The poppy," according to Mr. Impey, "takes three months and a half to arrive at perfection, at least to the transitory and half-ripe state, between the fall of the petal and the dehiscing of the pericarp, which is the period most favourable to the extraction of the juice; and it grows to the height of four feet and upwards when well attended to. Its erect stem is divided into from four to fourteen branches, which strike off at various heights, the lowest usually two and a half feet from the ground. The capsule, in a full-grown state, measures frequently three and a half inches long by two in diameter."

A second drawing represented a native woman pulling off the poppy petals for the purpose of making leaves for the envelop of the opium for the China market. Each cake or ball of opium is calculated to consume five chittacks¹ of these leaves.

Speaking of the cultivation of the poppy in Malwa, Mr. Impey says:—

"The petals and leaves, which are in other districts kept to form the covering for the cakes, are permitted to fall off, and not applied to any purpose, nor even sold by the ryot; but poor people gather them, and when a sufficient quantity is collected and pounded, dispose of them at six rupees per maund to the Buniahs and opium-dealers, who require them for packing and wrapping the cakes."

The next operation is that of tapping or bleeding the poppy capsules. This is effected by making a series of parallel wounds in the exterior surface of the capsule with the instrument called a *nushtur*. This consists of several (three, four, or five) heart-shaped lancets or blades, tied together with some cotton thread. In one of these nushturs or incising instruments there were three lancets, while in another there were four, in both cases bound together by cotton. Mr. Johnson says that the wounds in the capsules ought to be made diagonally, in order to prevent the juice falling off in the night, when the dews are heavy; and Mr. Impey states that in Bengal they are made so. But in some cases the incisions are made perpendicularly. Speaking of the nushtur, Mr. Impey states that so much only of the points is allowed to protrude "as is actually necessary, so that no discretion or latitude in manipulation is left to the labourer; the length of the point which protrudes externally is one-twelfth of an inch, and the distance between each blade is one-eighth of an inch. The area of the beegah is at this time imaginarily divided into three or four compartments, and the labour apportioned accordingly, the different processes of bleeding or gathering the juice going on separately in each, when the previous one has been finished; three men are employed, and in this way each plot is bled every three or four days. Twelve days are required to complete the operation, so that each capsule becomes wounded three, and occasionally four and six times, if the heads are large; but this is not of frequent occurrence.

"The mode of wounding the capsule is as follows: Being depressed, and held almost horizontally, to admit of greater facility and steadiness in cutting, the inci-

¹ A chittack, or chitak, is equal to 1 oz. 17 dwts. 12 grs. English troy weight.

sions are made longitudinally, and from below upwards, about 3 P. M., or in the hottest part of the day, and after the collections from former incisions have terminated. A small quantity of white milky juice exudes almost immediately upon the incision being made, of the consistence of cream, on the surface of which after a short time a slight pellicle is formed by the power of the solar rays. The object of making the incisions at this hour is to obtain this result. By the continued force of the solar influence, a greater degree of evaporation and inspissation takes place (but not sufficiently to close the orifices of the wounds), which prevents the juice falling off the capsule, although, when the night dews are heavy, or the juice very plentiful, this cannot altogether be avoided. The greatest exudation occurs in the night-time, from the dew washing and clearing the incisions, and favouring the escape of the juice. During the night, the juice continues to ooze out gradually, and in the morning it is fit for removal. By this time it has altered its appearance. Instead of the white milky character which it had before, it assumes a thick gummy consistence, and exhales a powerfully narcotic smell; it is much darker, of a light drab colour, and streaked with deeper shades of the same and red and black striæ, the latter known as *paséwá*—a term, as the meaning implies (perspiration or exudation), literally applicable to the whole mass, but used to denote this especial appearance (see *ante*, p. 1017). The nature of the juice is perhaps best understood by the native name applied to it in Central India, viz. (*Anglice*) slime."

A third drawing represented the natives engaged in scraping off the exuded juice. "Scraping, the next process," says Mr. Impey, "is commenced on the following morning at sunrise, and executed with rude blunt iron scrapers, resembling a cleaver in miniature. A small piece of cotton soaked in linseed oil is stuck on the upper part of the blade, and both the thumb and edge of the scraper are occasionally smeared with it, to guard against the glutinous effects of the juice, which would otherwise adhere strongly to the fingers. Towards the point of the scraper the most pure juice is gathered, for there the first scrape is made; the second is done more with the heel of the instrument, near the handle, and the juice is much lighter in colour. It is during this operation that the first sophistication occurs, the scraper being carried heavily over the capsules, taking with it a considerable part of the beard or pubescence. The manner in which scraping is performed is by grasping the capsule between the thumb and forefinger of the left hand, inclining it gently as in bleeding; the thumb of the right hand being then placed on the top of it, the scraper is drawn briskly upwards, almost similar to the making of a pen. This is repeated twice; every head is of course submitted to the process, and each is considered to yield a weight of juice equivalent to about 15 grains troy. In full-grown fruitful fields, each man will collect upwards of half a pound of chick per day, at least, by 10 A. M., by which time this part of the work is over."

Dr. Butter, in his account of the preparation of opium for the China market, observes that "the goodness of the soil, and the management of the irrigation, are circumstances which powerfully affect the strength of the juice at the time of its collection; but a third agent, still less amenable than these to control, now comes into play, the precipitation of *dew* on the surface of the capsule. When a current of wind, or a cloudy sky, prevents the formation of dew, it is found that the scarifications made in the capsule about the middle of the preceding day are sealed up by the slight oozing of juice which had immediately followed the incisions, and the quantity of opium obtained is small. When, again, the dew is abundant, it washes open the wounds in the capsule, and thus facilitates the flow of the milk, which in *heavy* dews is apt to drop off the capsule entirely, and be wasted. But when the dew is in moderate quantity, it allows the milk to thicken by evaporation, and to collect in irregular tiers (averaging one grain of solid opium from each quadruple incision), which on examination will be found to have a greater consistency, and a 'rose-red' colour towards the external surface, while the interior is semifluid, and of a 'red-dish-white' colour. This inequality of consistence constitutes the *grain of raw opium*, of which I shall have to speak hereafter.

"In the collection of these drops of half-dried juice, it is very apt to get mixed with the dew, which, in the earlier hours of collection, continues to besprinkle the capsules, and which here does a double mischief—first, by retarding the inspissation of the general mass of the juice; and, secondly, by separating its two most remarkable constituent parts—that which is soluble, and that which is insoluble in water. So little aware, or so reckless, even under the most favourable construction of their conduct, are the *koéris*, of the injury thus caused by the dew, that many of them are in the habit of occasionally washing their scrapers with water, and of adding the washings to the collection of the morning. In Malwa, *oil* is used for this purpose, to the irremediable injury of the flavour of the opium. On examining the juice thus mixed with water, it will be found that it has separated, as above mentioned, into two parts, a fluid, and a more consistent portion; the latter containing most of the resin, gluten, caoutchouc, and other less soluble constituents of opium, with part of the super-meconiate of morphia; and the former containing the gum, some resin, and much of the super-meconiate of morphia, and much of the colouring principle, which, though pale at first, is rapidly affected by light, and acquires a very deep 'reddish or blackish brown' colour. Many *koéris* are in the habit of draining off this fluid portion into a separate vessel, and of bringing it, under the name of *paséwá*, for sale, at half the price of opium, to the Benares agency, where it is used as *léwá* (paste for the petal envelops of the cakes). Others, after allowing the soluble principles to become thus changed into an acescent, blackened, sluggish fluid, mix it up with the more consistent part of their opium, and bring the whole for sale in this mixed state; the consequence of which is, that they are subjected to a penalty, called *battá* upon *paséwá*, and regulated by the estimate of the opium-examiner of the quantity of *paséwá* contained. This penalty is the only efficient check upon this most pernicious practice of the *koéris*, for on the generality of the *gomáshias* it is difficult to impress the necessity of their looking after the *koéris* during the collecting season."

Mr. Impey, alluding to the practice in Malwa, says: "When the capsules crack and turn brown they are pulled off the stalks, and the seed shaken out; the heads are then thrown away. In poor districts, where the people cannot afford the indulgence and luxury of opium for smoking and chewing, the poppy heads are made into a decoction, and the liquid drunk in its stead. This liquid, from the Persian name of the capsule, is termed 'Post.' But another and more useful application of the capsules is also exercised; they are ground into fine powder, and, like the leaves, sold, under the name of *boosa*, to the retailers, and sprinkled over the *buttees* of opium, both to prevent their adhesion and to form a covering for them.

"The seeds are a very useful part of the plant, and very plentiful. From two to five maunds are procurable from a beegah, which obtains ready sale at 12 to 16 seers for a rupee; a very small quantity being required for seed, the rest is converted into oil, which, according to the native mode of expression, gives one-third in weight. According to Dr. O'Shaughnessy, it yields 56 per 100. It is of a pale yellow colour, clear, burns well, but is not adapted for lamps, on account of the smoke and smell which it gives out. The oil is very cheap, selling at eight seers per rupee; and the refuse is an extremely wholesome and nutritious food for cows, termed here *Khari*; it sells at the low rate of eight annas per maund. Lastly, the stalks, which might be made use of for firewood, are left in the ground untouched and unheeded."

The juice which is scraped off the poppy-heads is collected in shallow earthen pans, and is removed in these from the fields. A fourth drawing represented a native engaged in this operation.

A fifth represented two natives engaged in manipulating the opium, with a view to its introduction into the earthen vessels or bottles (called *gumlahs*). The lower half of each is surrounded with wicker-work, to protect the vessels. The native dealers judge of the consistence of opium by the feel. Dr. O'Shaughnessy says

that the opium brought to the factories contains from 64 to 68 per cent. of solid matter, but that by evaporation it reaches the consistence of 70—the standard of the factory for the Chinese investment.

Dr. Butter observes, that “in the Benares shells the *léwá*, or paste for uniting the poppy petals, remains visibly interstratified with them, dark coloured, and tenacious; while in the *Behar* it is in a great measure absorbed by the petals, which are apparently in intimate contact with each other, and is not to be distinguished from them.” He farther observes that “any strong cheap mucilage or farinaceous paste, or perhaps some indigenous imitation of birdlime, would answer for the inner portion of the shell; and an exterior coating of a resinous, waxy, or oily nature, impervious to water, would defend this from the moisture of the air.” In reference to the shape of the cakes, he says: “The shape ought to be as nearly spherical as possible, that being the geometrical form which, under the smallest surface, contains the greatest quantity of matter, and which, consequently, affords the least scope for the extrication of air, and ultimate injury to the shape of the cake when that air escapes. Greater attention to boring the earthen cups in which the cakes are dried *perfectly* hemispherical, instead of parabolical, as they now are, would contribute to the desired sphericity.”

DESCRIPTION.—In commerce, several varieties of opium are known. The principal kind, however, is that brought from Smyrna. But the recent events which have occurred in China will probably throw a considerable quantity of Indian opium into European commerce.

1. **Smyrna Opium** (*Opium Smyrnæum*).—This is the *Turkey* or *Levant* opium of commerce. It occurs in irregular rounded or flattened masses of various sizes, rarely exceeding two lbs. in weight, enveloped in leaves, and usually surrounded with the reddish capsules of some species of *Rumex* (*R. orientalis*, according to Koch;¹ but *R. Patientia*, according to Merat).² Some of the flat cakes are without the capsules, and somewhat resemble Constantinople opium. When first imported, the masses are soft, and of a reddish-brown colour; but, by keeping, they become hard and blackish. Its lustre is waxy; its odour is strong and unpleasant; its taste is bitter, acrid, nauseous, and persistent. M. Guibourt regards the masses as being made up of agglutinated tears, and on this account as being the purest met with. It is, however, frequently found largely adulterated. From one sample, weighing 10 ounces, I obtained 10 drachms of stone and gravel. Notwithstanding occasional frauds of this kind, Smyrna opium affords the best commercial opium. It yields more *morphia* and *meconic acid* than either Constantinople or Egyptian opium.³ The quantity of *morphia* which can be obtained from it is, perhaps, on the average, about eight per cent. Pelletier,⁴ in an operation on about two ounces of this opium, procured a quantity of *morphia* equal to 7.08 per cent. From a pound, he calculates that eight or nine per cent. could be obtained. On an average 12 per cent. of hydrochlorate of *morphia* may be procured from it. Dr. Christison obtained two drachms of *narcotine* from half a pound of the best Turkey opium; hence, we may estimate the quantity at about four per cent. Hydrochlorate of *morphia*, prepared by Gregory's process from Turkey opium, contains, according to Dr. Gregory,⁵ one-twelfth of codeia. Merck⁶ examined five kinds of Smyrna opium; from the worst he procured 3 to 4 per cent. of *morphia*; from the best 13 to 13.5 per cent. In the latter variety, he found 0.25 per cent. of codeia.⁷

2. **Constantinople Opium** (*Opium Bizantinum* seu *Constantinopolitanum*).—I am indebted to Professor Guibourt for an authentic sample of this. His description of it is as follows: “There are two sorts of it; one in very large irregular

¹ T. W. C. Martius's *Pharmakogn.* S. 322.

² Berthemet, *Journ. de Pharm.* xxiv. 444.

³ *Ibid.* xxi. 246.

⁴ *Dict. Mat. Méd.* t. v. p. 50.

⁵ *Ibid.* xxi. 572.

⁶ *Pharm. Central-Blatt für 1836*, S. 491.

⁷ [Smyrna opium rasped, then mixed with common filtered water and allowed to remain in the liquor, yields a solution which powerfully retards the putrefaction of any animal matter placed therein. Dr. Pereira, in *Pharm. Journ.* vol. xi. p. 135.—ED.]

cakes, which are flattened like the Smyrna opium. This is of very good quality. The other is in small, flattened, regular cakes, of a lenticular form, from two to two and a half inches in diameter, and covered with a poppy leaf, the median nerves of which divide the disk into two parts. It has an odour similar to the preceding kind, but more feeble; it blackens and dries in the air. It is more mucilaginous than Smyrna opium." To this account I may add that the cakes are never covered with the *Rumex* capsules, as those of Smyrna opium are. Berthemot describes two kinds of it; one soft, the other hard and brittle. Constantinople opium is inferior to the Smyrna kind, but superior to Egyptian opium. Professor Guibourt says that this kind of opium yields only half the morphia procurable from the Smyrna opium. Berthemot also states that, though it yields more morphia than the Egyptian opium, it gives less than the Smyrna kind. This, however, does not agree with the experience of Mr. Duncan, of Edinburgh, who has never failed to obtain an extraordinary quantity of hydrochlorate of morphia from it. From an experiment of Dr. Christison's, he calculates the quantity of hydrochlorate of morphia obtainable from it at 14 per cent.¹ Merck² procured 15 per cent. of pure morphia, but scarcely a trace of codeia. It is obvious, therefore, that Constantinople opium is of unequal quality. It is probable that opium of unequal qualities, and produced in several parts of the Turkish empire, is carried to the capital, and, being exported from thence, bears the name of Constantinople opium.

3. **Egyptian Opium** (*Opium Ægyptiacum*).—It occurs in round flattened cakes of about three inches diameter, covered externally with the vestiges of some leaf. It is usually very dry. It is distinguished from the two preceding varieties by its reddish colour, analogous to that of Socotrine or hepatic aloes. Some very inferior qualities are sometimes offered for sale, and which appear to the sight and touch to be largely adulterated. By keeping, it does not blacken like the other kinds; its odour is less strong, and somewhat musty. Guibourt says, that by exposure to the air it becomes soft. Egyptian opium is for the most part inferior to either of the preceding kinds; but its quality is by no means uniform. Some kinds become damp by keeping. Guibourt tells us it yields only five-sevenths of the morphia obtained from Smyrna opium. Berthemot also states that it contains less morphia than either of the preceding kinds of opium, and that the morphia is more mixed with narcotine. He farther adds that the morphia which it yields is purified with great difficulty. The watery infusion of Egyptian opium has a distinct odour of acetic acid. Dr. Christison obtained about 10 $\frac{1}{4}$ per cent. of pure white hydrochlorate of morphia from it, which, he says, is about the quantity procured from good Turkey opium. Merck³ procured only from 6 to 7 per cent. of morphia, but much meconic acid.

4. **Trebizond Opium** (*Persian Opium*).—Some years since a quantity of opium was imported into this country from Trebizond, in the form of cylindrical sticks, which, by pressure, have become somewhat angular. Their length is about six inches; their diameter about half an inch, a little more or less. Each one is enveloped in a smooth shiny paper, and tied with cotton; its colour is similar to that of Socotrine aloes. It has the opiate odour stronger than that of the Egyptian kind, but less than Smyrna opium, and mixed somewhat with a musty odour; its taste is intensely bitter. It is commonly termed in commerce Persian opium, but the specimens I received came from Trebizond. It is a very inferior kind. Merck⁴ could obtain no morphia from it by the ordinary mode of proceeding. He, however, afterwards succeeded in obtaining about 1 per cent. It gave only a trace of narcotina. There must, I suspect, be some error in these statements, as this opium is certainly richer in morphia than is here stated.

5. **Indian Opium** (*Opium Indicum*).—Three varieties of Indian opium are known in commerce, viz: *Malwa*, *Benares*, and *Patna Opium*. As the two latter

¹ Journ. de Pharm. xxi. 547.

² Op. supra cit.

³ Pharm. Central-Blatt für 1836, S. 491.

⁴ Pharm. Central-Blatt für 1836, S. 493.

kinds are undistinguishable, I shall include them under one head of *Bengal Opium*.

a. Bengal Opium (Benares and Patna Opium).—Its preparation is fully described by Dr. Butter.¹ I have been kindly furnished with samples of the Benares and Patna kinds, of the growth of the years 1835—36, and 1837—38, by Mr. Maitland, of the India House.

Bengal opium is imported in balls, each weighing about three lbs. and a half, and packed in chests, each containing about forty balls. The balls are hard, round like cannon-balls, and about the size of a child's head. Externally, each ball is made of poppy petals, firmly agglutinated by a paste called *lewah*, to form a firm but laminated envelop weighing about 14 oz. On cutting through this, the opium is found to be quite soft, homogeneous, apparently quite pure, and to have the consistence of a soft extract. Its colour is blackish-brown. Its odour and taste are strong, and purely opiate. On exposure to the air this opium speedily becomes covered with mouldiness. Both *Bahar* or *Patna* and *Benares Opium* are exported from Calcutta. Bahar and Benares are the only districts of Bengal where opium is produced. Benares is most valued by the Chinese (Butter). Farther experiments are required, ere we can speak with confidence as to the percentage quantity of morphia and narcotina obtainable from Bengal opium. Dr. Smytten² procured only $2\frac{1}{2}$ or 3 per cent. of morphia. But from some experiments which I have made, I consider this quantity to be considerably below the truth. Mr. Morson informs me that Benares opium contains rather more than half the quantity of morphia contained in good average Turkey opium.

Garden Patna Opium.—For a sample of this opium I am indebted to Dr. Christison. It is imported in square cakes (inclosed in thin plates of mica), about three inches in length and breadth, and one inch thick. It has the appearance, as Professor Guibourt describes it, of a well-prepared, shiny, dry, pharmaceutical extract. Its colour is blackish-brown. Its odour is less powerful than that of Smyrna opium.

In the first edition of this work, I described this kind of opium as *fine Malwa opium*. The following extract of a letter which I received from Dr. Christison will explain the cause of this error: "The common ball opium of Patna and Benares (which are all but identical) was long known in India to be inferior in quality. During the inspectorship of Mr. Fleming, of Barrochan, he instituted inquiries, along with his assistant, Captain Jeremie, as to the causes of its inferiority, and, among other reasons, was led to suppose it owed its softness, tarriness, and general low quality, to the 'ryots' storing the juice in bottles till it accumulated to a sufficient extent to be made up, and to fermentation consequently taking place. Means were therefore taken to get this juice before being long kept, and it was made up into square cakes, of which I sent you one under the incorrect name of Malwa opium—the name by which I got it." Mr. Fleming subsequently recognized the cakes in Dr. Christison's laboratory with his official stamp on them. Dr. Christison obtained 9.5 per cent. of muriate of morphia (snow-white) from it, a considerable portion of narcotine, and so large a proportion as one-twelfth or 8 per cent. of codeia.

This I presume is the opium employed by Merck³ under the name of Bengal opium, and which, he says, was inclosed in plates of mica. In 100 parts, he found morphia 8, narcotine 3, codeia 0.5, thebaine 1, meconine traces, and porphyroxin 0.5. Another sample of Indian opium, in round balls of half a pound each, and of the consistence of Calabrian extract of liquorice, yielded him 10 per cent. of morphia.⁴

β. Malwa Opium.—A few years since, this ranked among the inferior kinds of

¹ On the Prepar. of Opium for the China Market, in *Journ. Asiat. Soc. of Beng.* v. 165, 1836. [See also the author's account of the manufacture, *ante*, p. 1018.—Ed.]

² *Trans. of the Med. and Phys. Soc. of Calcutta*, vi.

³ *Berl. Jahrb.* xxxvii. 289, 1837, and *Brit. Ann. of Med.* July 21, 1837.

⁴ *Pharm. Central-Blatt für 1836*, 493.

Indian opium, but it has been gradually rising in value, and is now highly esteemed. I have received two varieties of opium under this denomination. They were brought to me from India by former pupils of mine.

aa. One kind consists of a round flattened cake or ball, weighing ten ounces. It seems to have been packed in a coarse kind of dust, composed of broken poppy petals. Its consistence is about that of moderately firm Smyrna opium. When cut into, it presents a homogeneous texture. Its colour is dark brown; its odour similar to that of Smyrna opium.

ββ. The other kind (described in the first edition of this work as *inferior Malwa opium*) is in flattened cakes without any exterior covering. It is dull, opaque, blackish-brown, externally; internally, somewhat darker and soft. Its odour is somewhat like that of Smyrna opium, but less powerful, and combined with a slight smoky smell. Guibourt says it yields as much extract as Levant opium; but its insoluble residue wants the vinous odour and glutinous consistence of the latter. It furnishes only one-third the quantity of morphia yielded by Smyrna opium. From common Malwa opium Dr. Smytten procured only from 3 to 5 per cent. of morphia; but, from fine samples, from $7\frac{3}{4}$ to 8 per cent.

Mr. E. Solly¹ states that he found "occasional minute cavities full of a pale-yellow oil," in a specimen of Malwa opium. This opium yielded him 80 per cent. of soluble matter.

γ. *Cutch Opium*.—Under this name I have received from Bombay a small cake of opium, rather more than an inch in diameter, and apparently enveloped by the remnants of leaves. Its odour is much less powerful than that of Smyrna opium.

δ. *Kandeish Opium*.—In round flattened cakes, weighing about half a pound each. It is nearly black, is hard, brittle, and presents a gritty or granular fracture. It yielded Mr. E. Solly² 72 per cent. of soluble matter, and about 7 per cent. of morphia.

6. *English Opium* (*Opium Anglicum*).—It is in flat cakes or balls, enveloped with leaves. It resembles fine Egyptian opium more than any other kind; its colour is that of hepatic aloes; it has a moderately strong opiate odour.³ Mr. Hennell procured from 700 grains of English opium, prepared by Messrs. Cowley and Staines, 53 grains, or 7.57 per cent. of morphia; while from the same quantity of Turkey opium he obtained only 48 grains, or nearly 7 per cent. of morphia.⁴ Mr. Morson,⁵ from 20 oz. avoird. of the same British opium, procured only 384 grains, or about 4.4 per cent. of morphia, and 222 grains, or about 2.53 per cent. of narcotina. Probably the morphia obtained by Mr. Hennell was not freed from narcotina. Mr. Young declares British opium to be stronger than the commercial opium; six ounces of the former being equal to eight of the latter.⁶

7. *French Opium* (*Opium Gallicum*).—I have not seen any samples of this. Pelletier⁷ describes it as being of a deep reddish-brown colour, and brittle when dry. Its taste was somewhat different from that of Smyrna opium. It left a less insoluble residuum than Eastern opium. Pelletier procured more morphia from it than from Smyrna opium. In an experiment on about two ounces of each, he obtained about 10.38 per cent. from the former, and only 7.08 per cent. from the latter. It contained no narcotina. He obtained sensible traces of *codeia*, but none of *narceine*, *meconine*, or *thebaine*, perhaps because the quantity of opium experimented on was too small. The disappearance of one immediate principle (narcotina), and the augmentation of another (morphia), caused by climate, are interesting facts. Petit⁸

¹ *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 141, Lond. 1841.

² *Op. supra cit.*

³ I must refer those interested in the cultivation of the poppy, and production of British opium, to the papers of Mr. Ball, in *Trans. Soc. of Arts*, xiv. 253; of Mr. Jones, *Ibid.* xviii. 161; of Mr. Young, *Ibid.* xxxvii. 23; of Messrs Cowley and Staines, *Ibid.* xl. 9; and of the Rev. G. Swayne, *Quart. Journ.* vols. viii. and ix.

⁴ *Trans. Soc. Arts*, xliii. 57.

⁵ Duncan, *Suppl. to the Ed. Disp.* p. 81.

⁶ *Ibid.* xliii. 183.

⁷ *Ibid.* l. 25.

⁸ *Journ. de Pharm.* xxi. 570.

got from 16 to 18 per cent. of morphia; and Caventou (quoted by Christison) obtained from 22 to 28 per cent. from French opium; but, I presume, the morphia was very impure.

8. **German Opium** (*Opium Germanicum*).—Biltz, of Erfurt, obtained from indigenous German opium 16½ and even 20 per cent. of morphia, where the opium had been procured from the *P. somniferum*, α . *nigrum*; and between 6½ and 9½ narcotina. But from opium made from *P. somniferum*, β *album*, he got conversely 6.8 per cent. of morphia, and 33 per cent. of narcotina.

COMMERCE OF OPIUM.—The quantities of opium on which duty was paid during six years, were as follows:—¹

In 1834	27,253 lbs.	In 1838	30,824 lbs.
1835	30,398	1839	40,784
1836	32,553	1840	45,589
1837	36,533	1841	37,960

Since August 13, 1836, the duty has been 1s. per lb; previous to that, and from 1828, it was 4s. per lb. Of the above quantities, the greater part was imported from Turkey. The quantity of opium produced in Hindostan is enormous. In Patna and Benares its cultivation is a monopoly in the hands of government; and a revenue is derived from the Malwa opium, by a system of passes on shipment from Bombay. Of the whole quantity raised in Hindostan, it is² calculated that about two-thirds have been sent to Canton, and the remainder to the Eastern Islands.³ The following table is from Mr. R. Montgomery Martin's *Statistics of the Colonies of the British Empire*, London, 1839 (p. 366).

Estimate of Quantity and Total Value of Indian Opium consumed in China during the years ending in 1832—33.

Years.	Patna.	Benares.	Malwa.	Total.	
	Chests.	Chests.	Chests.	Chests (of one pecul, or about 133½ lbs. avoird.)	Amount in Spanish Dollars.
1827—28	4006	1128	4401	9535	10,425,075
1828—29	4831	1130	7171	13132	12,533,215
1829—30	5564	1579	6857	14000	12,057,157
1830—31	5085	1575	12100	18760	12,904,263
1831—32	4442	1518	8265	14225	11,501,584
1832—33	6410	1880	15403½	23693½	15,352,426

All the world knows that these enormous quantities of opium were smuggled into China (by the connivance of the local authorities) for the purpose of smoking. The vessels anchored at Lin-tin, about seventy miles from Canton, and delivered the opium to the boats of the Chinese buyers. "Malwa opium is considered by the Chinese as having a higher touch, but not so mellow nor so pleasant in flavour as the Patna opium. The smokable extract, which each quantity of opium contains, is thus intimated by the Chinese—(who use opium as we do wine or spirits): Patna and Benares opium 45 to 50 touch—average 48; Malwa 70 to 75—average 72½; Turkey 53 to 57—average touch 55."³ The *smokable extract* here referred to, is an aqueous extract of opium prepared by the Chinese. A detail of the important events which have resulted from the active and extraordinary steps taken by this remarkable people to put a stop to the trade in opium, would be out of place in this work. Suffice it to say that, in 1839, no less than 20,283 chests of opium, valued at nearly £3,000,000 sterling, were delivered up to the Chinese, and by them destroyed by immersing the opium in water with lime and salt, and, when the whole had become a fetid mud, allowing it to escape into the river.⁴

COMPOSITION.—Few substances have been so repeatedly submitted to chemical investigation as opium. The mere reference to the different labours which have

¹ Trade List.

² Evid. taken before the Committee of the House of Lords on the Affairs of the East India Company, No. 646, 1830, p. 25.

³ R. M. Martin, *op. supra cit.* p. 366.

⁴ See *Asiatic Journal*, vol. xxx. part. ii, p. 310; also *Parliamentary Reports on the Trade with China*, No. 359, 1840; and *Corresp. relating to China*, 1840.

been bestowed on it, would occupy more space than I can devote to the subject. I must, therefore, content myself with brief notices of the most important epochs in its chemical history, and a reference to some of the analyses which have been made of it.

In 1803 Derosne¹ discovered *narcotina*. In 1804 Sertürner² announced the existence of *meconic acid* and *morphia*. Seguin³ appears to have discovered them about the same time. Robiquet⁴ confirmed these discoveries in 1814. In 1826 *meconine* was discovered by Dublanc Jeune, and again, in 1830, by Couerbe.⁵ In 1832 Pelletier⁶ discovered *narceina*; and, in the same year, Robiquet⁷ announced the existence of *codeia*. In 1837 Merck⁸ announced the existence, in opium, of a new substance, which he called *porphyroxin*; but his statement requires confirmation.

Analyses of opium have been published, in 1800 by Bucholz,⁹ in 1804 by Sertürner, in 1814 by Seguin, in 1817 by Braconnot,¹⁰ in 1818 by Buchner,¹¹ in 1819 by John,¹² in 1823 by Pfendler,¹³ in 1824 by Lindbergson,¹⁴ in 1826 by Merck,¹⁵ in 1826 by Geiger,¹⁶ in 1831 by Biltz,¹⁷ in 1832 by Pelletier,¹⁸ in 1834 by Schindler,¹⁹ and in 1836 by Mulder.²⁰

<i>Mulder's Analysis.</i>	<i>Smyrna Opium.</i>				
	1	2	3	4	5
1. Morphia	10.842	4.106	9.852	2.842	3.800
2. Narcotina	6.808	8.150	9.360	7.702	6.546
3. Codeia	0.678	0.834	0.848	0.858	0.620
4. Narceine	6.662	7.506	7.684	9.902	13.240
5. Meconine	0.804	0.846	0.314	0.380	0.608
6. Meconic acid	5.124	3.968	7.620	7.252	6.644
7. Fat	2.166	1.350	1.816	4.204	1.508
8. Caoutchouc	6.012	5.026	3.674	3.754	3.206
9. Resin	3.582	2.028	4.112	2.208	1.834
10. Gummy extractive . .	25.200	31.470	21.834	22.606	25.740
11. Gum	1.042	2.896	0.698	2.998	0.896
12. Mucus	19.086	17.098	21.068	18.496	18.022
13. Water	9.846	12.226	11.422	13.044	14.002
Lo-s	2.148	2.496	0.568	2.754	3.332
<i>Smyrna Opium</i>	100.000	100.000	100.000	99.000	99.998

¹ *Ann. de Chim.* xlv. 257.

² *Trommsdorff's Journ.* 1805, Bd. xiv. 1, S. 47.

³ *Ann. de Chim.* xcii. 225; and *Ann. de Chim. et. Phys.* ix. 282.

⁴ *Ibid.* l. 337.

⁵ *Ibid.* li. 259.

⁶ *Trommsdorff's Journ.* viii. S. 24.

⁷ Quoted by Schwartz, *Pharm. Tab.*

⁸ *Chem. Abhandl. üb. d. Opium*, Wien, 1823.

⁹ *Ibid.*

¹⁰ *Pharm. Central-Blatt für* 1831, S. 757.

¹¹ *Pharm. Central-Blatt für* 1834, S. 751.

¹² *Ibid.* v. 275.

¹³ *Ibid.* l. 262.

¹⁴ *Pharm. Central-Blatt für* 1837, S. 342.

¹⁵ *Journ. de Phys.* lxxxiv. 225.

¹⁶ Gmelin, *Handb. d. Chem.* ii. 1244.

¹⁷ Gmelin, *op. supra cit.*

¹⁸ *Ibid.*

¹⁹ *Ann. de Chim. et de Phys.* l. 240.

²⁰ *Ibid.* für 1837, S. 574.

Schindler's Analyses.				Biltz's Analyses.			
	Smyrna Opium.	Constanti- nople Opium.	Egyptian Opium.		Oriental Opium.	Indigenous Opium.	
						From <i>a. nigrum.</i>	From <i>β. album.</i>
Morphia	10.30	4.50	7.00	Morphia	9.25	20.00	6.85
Narcotina	1.30	3.47	2.68	Narcotina	7.50	6.25	33.00
Codeia	0.25	0.52	} [90.32]	Meconic acid (im- pure)	13.75	18.00	15.30
Narceia	0.71	0.42		Bitter extractive	22.00	8.50	11.00
Meconine	0.08	0.30		Deposit	7.75	4.75	2.20
Meconic acid	4.70	4.38		Albumen	20.00	17.50	13.00
Resin	10.93	8.10		Balsamic matter	6.25	7.65	6.80
Bassorin, caout- chouc, fat, and lignin	26.25	17.18		Caoutchouc	2.00	10.50	4.50
Salts and vola- tile oil	3.60	3.60		Gum with lime . .	1.25	0.85	1.10
Lime & magnesia	0.47	0.42		Sulphate of pot- ash	2.00	2.25	2.00
Alumina, oxide of iron, silica, and phosphate of lime	0.24	0.22		Lime, iron, alu- mina, and phos- phoric acid	1.50	1.85	1.15
Brown acid, sol- uble in alcohol and water	1.04	0.40		Woody fibre	3.75	0.80	1.50
Brown acid, sol- uble in water; gum and loss . . .	40.13	56.49		Ammonia, vola- tile oil, and loss . .	3.00	1.10	1.60
Total	100.00	100.00	100.00	Total	100.00	100.00	100.00

The following substances may be regarded as the constituents of opium: *Morphia*, *narcotina*, *codeia*, *narceia*, *meconine*, *thebaina*, or *paramorphia*, *pseudomorphia*?, *meconic acid*, *brown acid extractive*, *sulphuric acid*, *resin*, *fat oil*, *gummy matter*, *caoutchouc*, *albumen*, *odorose principle* (volatile oil?), and *lignin*.

1. Volatile Odorous Principles (Volatile Oil?).—The distilled water of opium has the peculiar odour of this drug, and by keeping deposits aropy substance. Hitherto, however, all attempts to isolate the volatile odorous principle of opium have failed, and its nature, therefore, is as yet unknown. Nysten¹ swallowed two ounces of the distilled water without any sensible effect; and Orfila injected a like quantity of it into the jugular vein of a dog without apparently causing any inconvenience to the animal. The volatile principle cannot, therefore, possess much activity; but Nysten concludes that "the distilled water of opium, strongly saturated with the aromatic principle, is capable of producing drunkenness and sleep, when taken in a strong dose."

2. Morphia.—(This will be described hereafter.)

3. Codeia (Codeine).—So called from *κώδεια*, a poppy head. It is a white, crystalline solid, soluble in cold, and still more so in boiling water. It is soluble in alcohol and ether. It is insoluble in a cold weak solution of potash. If more codeia be added to boiling water than this liquid can dissolve, the excess melts and forms an oily layer at the bottom of the vessel; and, by cooling, a crystalline mass is obtained. It reacts as an alkali on test papers, and unites with acids to form crystalline salts. From morphia, codeia is distinguished by its not becoming blue on the addition of a persalt of iron. It is also said not to redden nitric acid like morphia (Turner). All the specimens of codeia which I have met with became orange yellow on the addition of nitric acid. Moreover, ammonia does not precipitate it from its very diluted solution in hydrochloric acid, on account of its solubility in water; and this affords a means of separating morphia from codeia. The separation may be more easily effected by ether, which readily dissolves codeia; or by alkalies (potash or soda), which dissolve morphia, but leave codeia. From meconine it is distinguished by its aqueous solution possessing marked alkaline properties, as manifested by its action on test papers. Tincture of nutgalls produces a copious precipitate (*tannate of codeia*) in solutions of codeia.

[We have, like the author, observed that codeia and its salts acquire an orange yellow colour on the addition of nitric acid, and farther that it decomposes iodic acid like morphia, and sets free iodine. The specimen examined was considered to be pure, although it is possible that traces of morphia may be retained, and account for the reactions observed. Codeia is so soluble in water that the solution has a strong alkaline reaction. It readily yields well-defined prismatic crystals by the evaporation of its aqueous solution. These are larger, but have the same form

¹ Orfila, *Toxicol. Gén.*

under the microscope as those of morphia, viz. quadrangular prisms. When strong sulphuric acid is added to codeia it is somewhat reddened. On dropping into this mixture one drop of a solution of bichromate of potash there is an immediate decomposition, with change of colour, the liquid becoming rapidly green, from the liberation of green oxide of chrome. In this respect codeia resembles morphia. In fact, the chief chemical difference is that pointed out by the author, viz., the non-coloration on the addition of a persalt of iron."—Ed.]

Anhydrous codeia consists of $C^{35}H^{20}NO^5$, Symbol Cd^+ . It, therefore, contains an atom less of oxygen than morphia does. [There is the same relation between the formulae of Morphia and Codeia as between those of Cinchona and Quina.—Ed.] Its atomic weight is 284. Crystallized in ether it contains no water; but crystallized in water it retains two atoms of water of crystallization.

The salts of codeia have not been much studied. The *nitrate* readily crystallizes. The *tannate* is insoluble in water. The *double hydrochlorate* of morphia and codeia is the salt at one time sold as hydrochlorate of morphia, by those who prepared it by Gregory's process. Hence it has been termed by the French pharmacologists *sel de Gregory*.

The effects of codeia and its salts have been imperfectly examined by Kunkel, Gregory, Barbier, and Magendie, but the results are very conflicting. Kunkel¹ says it is a local irritant, becomes absorbed, excites the circulation, and produces convulsions; but that none of the animals on which the codeia was tried were either stupefied or paralyzed. Magendie,² however, says it causes sleep, and when exhibited in large doses, stupor. He considers one grain of codeia equivalent to half a grain of morphia; two grains excite nausea and vomiting. Barbier³ also states that it produces sleep. Dr. W. Gregory⁴ says that, in doses of five or six grains, it causes an excitement like that of intoxication, followed in a few hours by depression, nausea, and sometimes vomiting. Magendie proposes to use it as a substitute for morphia, to procure sleep and allay pain, in doses of from one to three grains. A *syrup of codeia* (composed of codeia grs xxiv; distilled water f ℥iv; sugar ℥viii) has been used in whooping-cough. The dose for a child of about seven years of age is a teaspoonful. It has been given in irritation of the gastric mucous membrane.⁵

4. Narcotina (Narcotine).—So called from *ναρκωτικός*, narcotic. The greater part of the narcotina of opium is in a free state, as it is removable by ether without the aid of either acids or alkalies. It is a white, inodorous substance, crystallizing in prisms, which are fluted or striated—distinguished from morphia by being insipid, very soluble in ether, insoluble in alkalies, by its not becoming blue on the addition of the sesquichloride of iron, by its not decomposing iodic acid, and, when quite pure, by its not yielding a brown colour when treated by chlorine and ammonia. Heated on paper over a candle it gives a greasy-looking stain to the paper. Nitric acid dissolves it, and acquires an orange tint. [Sulphuric acid turns it yellow, and on adding bichromate of potash green oxide of chrome is slowly set free.—Ed.] It does not affect vegetable colours, and by this character is readily distinguished from both morphia and codeia. It is insoluble in cold water, but dissolves in 400 parts of boiling water—in 100 parts of cold alcohol—or in 24 parts of boiling alcohol. The volatile oils also dissolve it; it is soluble in ether. It consists of $C^{46}H^{25}NO^{14}$. The salts of narcotina have been but little examined. They are more bitter than those of morphia, redden litmus, and are precipitated from their solutions by infusion of nutgalls and by the alkalies. The *hydrochlorate* is crystallizable. Both this and the *sulphate* are very soluble in water.

[Orfila has suggested a test for narcotina, which produces very striking results. If to the mixture of strong sulphuric acid and narcotina, a small fragment of nitrate of potash, or any nitrate, be added, the liquid speedily acquires a deep blood-red colour. Morphia treated in the same way gives a dingy brown or olive green colour. Conversely, a mixture of narcotine and sulphuric acid has been proposed as a test for nitric acid or a nitrate. It is the nitric acid which here operates, and the presence of a trace of nitric acid in sulphuric acid may be often revealed by the fact that when the latter is added to narcotina it acquires a reddish tint.—Ed.]

Narcotina is extracted from the residue of the opium which has been subjected to the action of cold water. This is treated with water acidulated with either acetic or hydrochloric acid, and to the filtered solution ammonia is added. The precipitate treated with boiling alcohol yields narcotina, which is deposited as the liquor cools. Narcotina may be separated from morphia by ether, which dissolves the narcotina, but leaves the morphia, or by a solution of potash, which dissolves the morphia, but leaves the narcotina, or by the cautious addition of weak acetic acid, which dissolves the morphia, and, unless the acid be greatly in excess, does not dissolve the narcotina.

When narcotina was first discovered, it was said to be the stimulant principle of opium; and Magendie states, a grain of it, dissolved in olive oil, produced the death of a dog in twenty-four hours, while twenty-four times this quantity was given, dissolved in acetic acid, with impunity. Orfila, at one time, declared it was inert, then that it acted like morphia, and subsequently that

¹ Journ. de Chim. Méd. ix. 223.

² Journ. de Chim. Méd. x. 214 and 337.

³ Journ. de Pharm. xxiv. 144.

² Formulaire, 8me. éd. 87.

⁴ Ibid. p. 219.

its operation was remarkable and peculiar. Bally asserts that, in a solid state, it is inert; for 129 grains may be given, at one dose, without exciting any obvious effect. The truth is, I believe, that narcotina possesses but little activity; and I presume, therefore, that the first experimenters with it employed an impure substance. Dr. Roots gave gradually increased doses of it, up to a scruple, without the least injury. The bitterness of its sulphuric solution led him to employ it in intermittents, as a substitute for disulphate of quina. More recently, attention has been drawn to it in India, by Dr. O'Shaughnessy,¹ as an Indian indigenous substitute for quina; and nearly 200 cases of intermittent and remittent fevers, treated by it with success, have been published.

[The proportion of Narcotina contained in the different varieties of opium is, according to Dr. O'Shaughnessy, for 100 parts of Bengal Opium, 3 parts, the same for Malwah opium, while Turkey opium yields only one per cent. (from notes).—Ed.] One of the products of the oxidation of Narcotine is Opianic acid; of the mode of procuring and properties of which we subjoin the following remarks, from the author's notes.

Opianic Acid.—This substance is most readily obtained, according to Liebig and Wohler, by the oxidation of narcotine in the following manner: Dissolve narcotine in an excess of dilute sulphuric acid, add to the solution finely powdered binocide of manganese, and apply heat. It will soon assume a yellow saffron-like colour, and evolve carbonic acid gas. Heat to boiling, which is to be kept up until no more carbonic acid gas escapes. Both the manganese and sulphuric acid must be in excess; test for these, and then filter whilst boiling. In cooling, the fluid will nearly wholly congeal, and form a magma of fine needle-like crystals of opianic acid. The mass is to be placed on a filter to allow the yellow-coloured fluid to pass off; wash several times with cold water, press as firmly as possible, and remove impurities by treating with animal charcoal, and repeated recrystallization from boiling water.

Opianic acid crystallizes in very small shining silky prisms of indefinite form. It is but slightly soluble in cold water, but more so in hot; so that a saturated solution, in cooling, nearly wholly crystallizes, like a solution of benzoic acid. It is also soluble in alcohol. It reacts as an acid though it has but a faintly sour and bitter taste. It readily melts, and forms a clear oil, which crystallizes on cooling, but remains amorphous if heated beyond the point of melting. It does not appear to be volatile, although it may be distilled over, a circumstance referable to its adhesion to the sides of the retort. Heated in the air it emits an aromatic odour (similar to narcotine, which it resembles in combustion), with a vivid flame and deposition of carbon. Opianic acid expels carbonic acid, and forms soluble salts, with bases. The salts of silver and oxide of lead crystallize in thin shining prisms and flakes. It contains no nitrogen.²

5. Narceine (Narceina).—So called from *ναρκυν, stupor*. It is a white, inodorous solid, crystallized in long, fine, silky needles, radiating in tufts from a centre, with a slightly bitter, and even somewhat metallic, taste. It dissolves in 230 parts of boiling water, or 375 parts of water at 60°. It fuses at about 198°, and at a higher temperature is decomposed. Narceine has several very striking properties by which it is distinguished from other substances. The first of these deserving of notice is the action of mineral acids on it. Thus the sulphuric, nitric, and muriatic acids, so diluted with water that they cannot alter the elementary composition of narceine, give this substance a fine light-blue colour, immediately on coming in contact with it. This alteration of colour does not appear to depend on any change in the elementary composition of narceine, since, by saturating the acids with ammonia, the narceine is precipitated unchanged. When much water is added, the blue colour disappears. Another peculiar trait of narceine is, that it forms a bluish compound (*iodide of narceine*) with iodine; heat and alkalis destroy the colour. These characters are sufficient to distinguish narceine from all other known substances. In addition, I may add that it does not form a blue colour with the sesquichloride of iron, as morphia does.

Narceine was at first supposed to be a vegetable alkali; but as it does not affect vegetable colours, nor combine with nor saturate acids, it is now regarded as a neutral principle. Narceine is composed of $C^{22}H^{20}NO^{12}$.

Two grains have been several times thrown into the jugular vein of a dog, without producing any appreciable effect. It is presumed, therefore, to be inert.

6. Meconine.—So called from *μῆκων, a poppy*. It is a white, crystalline, odourless solid. Its taste, which at first is scarcely perceptible, is afterwards sensibly acrid. The crystals are six-sided prisms, with dihedral summits. It fuses at 194°, and becomes a colourless, limpid fluid. At a higher temperature it may be distilled. It dissolves in 265 parts of cold water, or in eighteen parts of boiling water. It is soluble in alcohol and in ether. It is distinguished from morphia and codeia by its not possessing alkaline properties. From morphia it is farther distinguished by its great fusibility, its greater solubility in water, and its not becoming blue on the addition of sesquichloride of iron. Cold sulphuric acid dissolves meconine, the solution being limpid and colourless. If heat be applied, the liquid becomes dark. If the quantity of sulphuric acid be small in proportion to that of meconine, the liquid assumes a green colour. If chlorine gas be passed over fused meconine, the latter becomes blood-red, and on cooling

¹ Brit. and For. Med. Rev. vol. viii. p. 263.

² Journ. für prakt. Chemie, xxvii. pp. 97, 98.

forms crystals. The compound thus formed is composed of chlorine and some organic base: if the first be removed by oxide of silver, a white acid is obtained, which Couerbe calls *mechloic acid* ($C^{14}H^7O^{10}$). By the action of nitric acid on meconine we obtain *hyponitromeconic acid*, composed of one atom of meconine and half an atom of hyponitrous acid. Meconine is remarkable for not containing nitrogen. Its composition is $C^{10}H^5O^4$.

A grain dissolved in water, and injected into the jugular vein of a dog, produced no remarkable effect. Farther experiments, however, are required before we can positively declare it to be an inert substance.

7. Thebaine (Paramorphia).—So called from *Thebes*, an ancient city of Egypt. It is a white, crystalline, fusible solid, having an acrid, styptic taste, very soluble in alcohol and ether, but hardly at all soluble in water. It possesses alkaline properties, and dissolves in weak acids. From these solutions it is precipitated by alkalis. An excess of alkali cannot dissolve it, unless, indeed, the alkaline solution be very concentrated. It fuses at 302° , but does not volatilize at any temperature. It is distinguished from morphia by not becoming blue on the addition of the perchloride of iron, and by not forming crystallizable salts with acids. From codeia it differs in not crystallizing in large crystals, and in not forming crystallizable salts. With meconine and narcine it has no analogy, and from them it is distinguished by the want of the peculiar properties which characterize these bodies. It resembles narcotina more than any other substance, but is distinguished by the crystals being shorter or granular, and wanting the pearly brilliancy possessed by those of narcotina; by its acrid taste; by its fusibility at 302° ; by its greater solubility in alcohol; and by nitric acid when dropped on it converting it into a substance like a soft resin, before dissolving it. Pelletier considered it to be isomeric with morphia;—hence he called it *paramorphia*. According to Dr. Kane's analysis, it consists of $C^{25}H^{14}NO^3$; and its atomic weight is 202. Couerbe's analysis gives another atom of oxygen. The last-mentioned chemist says that, by fusion, the crystals lose two atoms of water. Magendie states that one grain injected into the jugular vein, or placed in the pleura, acts like brucia or strychnia, and causes tetanus and death in a few minutes.

8. Pseudomorphia.—This is a substance which Pelletier has occasionally met with in opium. It is a whitish solid, which, like morphia, dissolves in caustic alkalis, is reddened by nitric acid, and made blue by contact with the sesquichloride of iron. But it does not decompose iodic acid, and cannot form salts with acids. It consists of $C^{27}H^{18}NO^{14}$. It is not poisonous; at least, nearly eight grains, given to a rabbit, produced no effect. Pelletier thinks that pseudomorphia must be some combination of morphia, in which this substance has lost its poisonous properties.

9. Porphyroxin?—This name has been given by Merck¹ to a supposed new principle found in Bengat opium. It is described as crystallizable, fusible, soluble in alcohol, ether, and weak acids. Alkalis precipitate it from its acid solution. Farther experiments are required to determine its existence and precise nature.

10. Resin.—Brown, insipid, inodorous, softened by heat, insoluble in water and ether, but soluble in alcohol and in alkaline lyers. Nitrogen is a constituent of it.

11. Extractive.—The substance usually denominated the extractive of opium is probably a heterogeneous body. It is brown and acid, and has been supposed to be one of the active principles of opium. The reasons for this opinion are the following: In the *first* place, it has been asserted that after the morphia has been separated from an infusion of opium by magnesia, the filtered liquor gives by evaporation an extract which produces the same kind of narcotic effect that opium does.² *Secondly*, the effects of the known active principles of opium are not sufficiently powerful to authorize us to refer the whole of the active properties of opium to them. Thus, on an average, 100 parts of opium yield from 8 to 10 parts of morphia (the most active of the known constituents of opium), and, therefore, if this alkali were the only active principle, it ought to be 10 or 12 times as powerful as opium is. Now we know that morphia is but little, if at all, more active than opium, and, therefore, this last mentioned substance either contains some other active principle, or the activity of morphia is surprisingly increased by the principle or principles with which it is naturally in combination. Butler³ says the insoluble residuum possesses considerable narcotic qualities.

12. Fatty Matter.—Yellow or brownish. Probably colourless when pure. It reddens litmus, and unites with alkalis to form soaps, from which acids disengage it apparently unchanged.

13. Meconic Acid.—Hitherto found in the poppy tribe only. It is usually procured from meconate of lime by acting on it, in hot water, with hydrochloric acid. The meconic acid crystallizes on cooling. The formula of the anhydrous acid is $C^{14}HO^{11}$. The crystallized acid contains 9 equivalents of water; and the acid dried at 212° contains 9 equivalents of water. [The symbol of meconic acid is \bar{Me} . The formula of the anhydrous acid is $C^{14}HO^{11} = \bar{Me}$; of the acid dried at 212° , $C^{14}HO^{11} = \bar{Me} + 3 aq.$; of the crystallized acid, $C^{14}HO^{11} + 3HO + 9aq = \bar{Me} + 9aq$. It is admitted by chemists to be a tribasic acid.—Ed.] When pure it is in the form of white,

¹ *Pharm. Central-Blatt für 1837*, S. 342; and *Brit. Ann. of Med.* ii. 52.

² Berzelius, *Traité de Chim.* t. v. p. 136; and t. vi. p. 152.

³ *Op. supra cit.*

TABULAR VIEW OF THE PRINCIPAL CHARACTERS OF THE CRYSTALLINE PRINCIPLES OF OPIUM.

[illegible]

*** I have had no opportunity of verifying the statements in this column.

transparent, micaceous scales, which are soluble in four times their weight of boiling water. But at this temperature water decomposes it; carbonic acid is evolved, and a solution of *komenic acid* ($C^{12}H^{20}O^8 + 2 \text{ aq.}$) is obtained. Cold water dissolves a smaller quantity of meconic acid. Alcohol is also a solvent for meconic acid. By the dry distillation of meconic acid it loses carbonic acid and water, and becomes *pyromeconic acid* ($C^{10}H^{18}O^6 + \text{aq.}$).

The characteristics of meconic acid are as follows: 1st. It reddens the neutral sesquisalts of iron, forming the *meconate of the sesquioxide of iron*. Alkalies, protochloride of tin, and nitric acid, assisted by heat, destroy this red colour. A solution of corrosive sublimate, which destroys the red colour of sulphocyanide of iron, does not decolorize a red solution of meconate of iron. 2dly. It forms with a weak solution of *ammoniated sulphate of copper*, a green precipitate (*meconate of copper*). 3dly. It yields white precipitates (*meconates*) which are soluble in nitric acid, with *acetate of lead*, *nitrate of silver*, and *chloride of barium*. The acetates which, like meconic acid, redden the sesquisalts of iron, and might, therefore, be confounded with it, do not occasion precipitates with the salts of lead and of barium. [Besides, the meconate of lead is insoluble in acetic acid—En.] 4thly. It is not reddened by *chloride of gold*, which reddens hydrosulphocyanic acid and the sulphocyanides.

It deserves especial notice that many substances enjoy equally with meconic acid the power of communicating a red colour to the sesquisalts of iron. The following are some of them: the *acetates*, *hydrosulphocyanic acid*, and the *sulphocyanides*, the *saliva of man* and *of the sheep*, the *urine of man* (frequently), *infusion of white mustard*, *komenic*, *pyromeconic*, and *indigotic acids*, the liquid obtained by the action of hydrochloric acid on detonating silver, the decoctions of *Cetraria islandica* and of *Gigartina Helminthocorton*.

Meconic acid is believed to be an inert substance. Sertürner swallowed five grains of it without observing any effect. Sömmerring gave ten grains to a dog; Fenoglio and Blengini gave eight grains to dogs, crows, and frogs, and four grains to various men; in all cases no effects were observed.¹ Combined with bases it doubtless modifies their action. Meconate of soda, however, is not active, as Sertürner asserted. It is supposed that the effect of the morphia in opium is modified by its combination with meconic acid. I have already mentioned that this acid is said to be an antidote in cases of poisoning by corrosive sublimate. If, however, the statement be true, the fact is of little practical value, on account of the scarcity of the acid; for neither opium nor laudanum can be given in quantity sufficient to neutralize the effect of this salt, without proving deleterious. Moreover, we have other good and easily accessible antidotes. Anthelmintic properties have been ascribed to the acid and some of its salts.

CHEMICAL CHARACTERISTICS.—Litmus paper is reddened by a watery infusion of opium (or tincture of opium diluted with water), owing to a free acid (*meconic*). Sesquichloride of iron gives it a deep red colour (*meconate of iron*). Acetate and diacetate of lead occasion a copious gray precipitate (*meconate and sulphate of lead, with colouring matter*), which, treated by sulphuric acid or sulphuretted hydrogen, yields free meconic acid. Chloride of barium also causes a precipitate (*meconate and sulphate of baryta*). Ammonia renders the infusion turbid (*precipitated morphia and narcotina*). Tincture of nutgalls causes a precipitate (*tannates of morphia and codeia*). Nitric acid communicates to the infusion a red colour (*oxidized? morphia*). Iodic acid and starch cause, after some hours, a blue precipitate (*iodide of starch*). This last test does not always succeed. Chloride of gold causes a deep fawn-coloured precipitate.

APPLICATION TO MEDICO-LEGAL PURPOSES.—On examining the alimentary canal of persons destroyed by opium, it not unfrequently happens that no traces of the poison can be obtained. I have met with several instances of this, and others are referred to by Dr. Christison.² Either, therefore, opium is rapidly absorbed, and its unassimilated parts are thrown out of the system by the excretories, or the constituents of this substance are digestible and assimilable.

The characters available for the detection of opium are twofold, *physical* and *chemical*.

1. **PHYSICAL CHARACTERISTICS.**—Whether in the solid state, or dissolved in water or spirit, opium possesses three physical properties, by one or more of which it may be frequently recognized. These are, a *more or less brown colour*, a *remarkable and peculiar odour*, and a *bitter taste*. Of these the odour is the only characteristic one. In the alimentary canal it is strongest when the stomach is just opened, or when the opiate liquor is just reaching the boiling point. Other odours, however, frequently mask it. The analogy between the odours of lactucarium and opium deserves notice.

2. **CHEMICAL CHARACTERISTICS.**—The chemical tests of opium are those for meconic acid and morphia above mentioned. In a case of suspected poisoning, the stomach and duodenum (cut into small pieces) with their contents, are to be digested in distilled water, and the solution filtered successively through a sieve, muslin, and paper. A little acetic acid added to the

¹ Richter, *Ausf. Arzneim.* Bd. ii. S. 616.

² On Poisons.

water coagulates any caseum, and is thought to facilitate the solution of the morphia. Its presence in large quantity is objectionable, on account of the red colour produced by the action of the acetates on the ferruginous salts; this resembles the colour developed with these salts by meconic acid.

a. Application of Trial Tests.—To a small portion of the filtered liquid apply the following tests:—

1. A few drops of *tincture of chloride of iron*, which produces a red colour (*meconate of iron*) in an opiate solution.

2. Apply excess of *strong nitric acid*, which also reddens (*oxidizes? morphia*) opiate liquors.

3. Add *iodic acid* and *starch*, and set aside for twenty-four hours. Blue iodide of starch is sometimes formed if morphia be present (unless, indeed, the quantity be very minute).—The fallacies of these tests have been already stated (see MORPHIA).

The success or failure of these tests is not to be considered as absolutely decisive as to the presence or absence of opium.

β. Separation of the Morphia and Meconic Acid.—Add to the filtered liquor a considerable excess of a solution of acetate of lead, and set aside in a tall vessel for the precipitate (*meconate and sulphate of lead, with colouring matter*) to subside, leaving a clear liquor (*acetates of morphia and lead, &c.*). Pour off the latter, and collect the precipitate on a filter. Before adding the acetate of lead, it may be sometimes necessary to evaporate the liquor, in a water-bath, to the consistence of syrup, which is to be digested and boiled in alcohol, and the alcoholic tincture evaporated, and the residuum dissolved in water. To the filtered solution add the acetate of lead. This complication of the process is not usually necessary. Farthermore, by boiling with water, meconic acid is decomposed.

The above-mentioned clear liquor and the lead-precipitate are then to be tested (the first for morphia, the second for meconic acid), as follows:—

Proceeding with the lead-precipitate (meconate and sulphate of lead, and colouring matter).

Suspend the lead-precipitate in water contained in a conical glass, and pass a stream of sulphuretted hydrogen through it, to convert the lead into a sulphuret, which is to be removed by filtration. The clear liquor is then to be gently heated (to expel the excess of sulphuretted hydrogen), and, if necessary, concentrated by evaporation. Or add a few drops of diluted sulphuric acid to the meconate of lead, by which an insoluble sulphate of lead is formed, and meconic acid held in solution. Boiling decomposes the meconic acid. The tests for meconic acid are then to be applied, viz:—

- a.* Tincture of chloride of iron.
- b.* Ammoniacal sulphate of copper.
- c.* Chloride of gold.
- d.* Acetate of lead.

2. Proceeding with the clear liquor (solution of the acetates of morphia and lead).

Place the clear liquor in a conical glass, and pass through it a stream of sulphuretted hydrogen, to precipitate the lead, and then filter. Then boil the filtered liquor, and, if necessary, concentrate by evaporation. To the clear liquor apply the tests for morphia, viz:—

- a.* Strong nitric acid in excess.
- b.* Iodic acid and starch (several hours may be necessary for the success of this test).
- c.* Tincture of chloride of iron (this test will only succeed with solid morphia, or very concentrated solutions).
- d.* Ammonia.
- e.* Infusion of nutgalls (this test will not answer if much free acid be in the liquor).
- f.* Chlorine, and afterwards ammonia.

Dr. Christison observes, that “It will often happen, in actual practice, that the only indication of opium to be procured by the process consists in the deep red colour struck by permuriate of iron with the meconic acid. Now, will this alone constitute sufficient proof of the presence of opium? On the whole, I am inclined to reply in the affirmative.” I regret I cannot agree with him in this conclusion, since several other substances produce the same colour, and three of these are very likely to be met with in the alimentary canal, namely, the acetates (thus acetate of ammonia or acetate of potash administered medicinally), mustard and saliva. [It is also to be remarked that the colour of the acetate of iron is not destroyed by a solution of corrosive sublimate.—Ed.] In regard to saliva, he remarks: “It is seldom possible to procure a distinct blood-red coloration from the saliva, except by evaporating a large quantity to dryness, and redissolving the residue in a small quantity of water; and I question whether it can be separated at all after the saliva is mixed with the complex contents of the stomach.” I am sorry again to be at issue with so high an authority, but our results being discordant, it is but right I should state my experience. In a large majority of cases, I find saliva is distinctly and unequivocally reddened by the persalts of iron. In some few cases only have I observed this test indistinct. I have several times obtained from the stomachs of subjects in the dissecting-room a liquor which reddened the salts of iron.”

ESTIMATION OF THE PURITY AND STRENGTH OF OPIUM.—Opium is brought into the market of very unequal degrees of purity, in consequence of its having been subjected to adulteration; and partly, perhaps, from the employment of dif-

ferent methods of preparation. Moreover, its consistence is by no means uniform; that of some kinds being quite soft (as the Patna and Benares), and of others quite hard (as some of the Egyptian opium). As this difference depends on the presence of unequal quantities of water, an obvious variation of strength is the consequence. Moreover, the quantity of morphia in good opium of different or even of the same localities is by no means constant. Furthermore, opium, from which the morphia has been extracted, has been fraudulently introduced into commerce.¹ It is highly desirable, therefore, to have a ready, easy, accurate, and precise method of determining the purity and strength of opium. I regret to state that such a method is still a desideratum.

1. OF THE ESTIMATION OF THE WATER.—This will be readily judged of by the consistence, but still better by observing the loss on drying a given weight of the opium at 212°.

2. OF THE DETECTION OF FOREIGN BODIES.—A physical examination of opium will frequently detect impurities (as leaves, bullets, stones, fruit, &c.). If a decoction of the suspected opium be made and strained, various foreign matters are left on the sieve. In this way, I obtained 10 drachms of small stones and gravel from 10 ounces of opium. On another occasion I detected a gelatiniform substance, which was insoluble in both water and alcohol, in an opium (Egyptian?), the tincture of which could not be rendered clear by filtration. A decoction of opium, when cold, should not give a blue precipitate (*iodide of starch*) on the addition of tincture of iodine; if it do, the presence of starch or flour is obvious.

3. OF THE ESTIMATION OF THE QUANTITY OF MORPHIA IN OPIUM. (*Morphiometry*).—This is a subject of no slight difficulty. A remark connected with it, which deserves notice, is that there is no constant ratio between the quantity of morphia in a given sample of opium and that of any other constituent. Berthelot,² however, is of opinion that it is in the ratio of that of the meconic acid. The correctness of this opinion is not borne out by my own observation, and was positively denied by Robiquet.³ It follows, therefore, that the extraction of the morphia is the only true morphimetric method of proceeding. Several methods of effecting this have been proposed.

a. Process of the Edinburgh Pharmacopæia.—"A solution of 100 grains, macerated twenty-four hours in two fluidounces of water, filtered, and strongly squeezed in a cloth, if precipitated by a cold solution of half an ounce of carbonate of soda in two waters, and heated till the precipitate shrinks and fuses, will yield a solid mass on cooling, which weighs, when dry, at least 11 grains, and, if pulverized, dissolves entirely in solution of oxalic acid."—*Ph. Ed.* 1839. This is a modification of the process for procuring disulphate of quina, and of estimating the quality of yellow bark. The fused mass obtained by the process is morphia, narcotine, and resinous extractive. From the trials I have made of this process, I am inclined to speak very doubtfully of its value. Morphia is soluble in a solution of carbonate of soda, and, therefore, variations in the degree of heat applied to the liquor, as well as in the time during which it is subjected to heat, will be attended with corresponding variations in the results. Nay, if the heat be maintained too long, the whole of the morphia will be dissolved! Hence, therefore, to prove successful, this process requires more precautions than the directions of the College would lead one to imagine.

β. Thiboumery's process.—Prepare an aqueous extract of the opium to be examined, and dissolve it in water. Add ammonia to the boiling liquor [taking care not to add much excess], and, when cool, filter. Wash the precipitate on the filter first with cold water, then with proof spirit, and afterwards dry it. Then boil it with animal charcoal in rectified spirit, and evaporate the filtered liquor, by which crystals of morphia are procured.⁴—The following modifications of the process will be found valuable: After the precipitate on the filter has been washed with water, dry it, mix it with proof spirit, and add drop by drop acetic acid until the solution slightly reddens litmus. By this means the morphia, and not the narcotina, will be dissolved. Precipitate the morphia from the filtered solution by ammonia. This perhaps is the best process for determining the goodness of opium at present known.

γ. Berthelot's process.—To a filtered infusion of opium add chloride of calcium, boil, filter (to get rid of the meconate and sulphate of lime), and evaporate to the consistence of syrup. The residuum should form a granular crystalline mass (principally hydrochlorate of morphia), which is to be separated from the mother-water, and purified by resolution in water.⁵ This is an application of Gregory's process, hereafter to be described. It appears to be an objectionable method, as a considerable portion of the morphia will be left in the mother-liquor.

δ. Couerbe's process.—Boil an infusion of opium with lime (which dissolves the morphia), and filter through paper. Saturate the filtered liquor with an acid, and precipitate the morphia by ammonia. This, perhaps, is the most speedy process for the detection of opium.

¹ *Journ. de Pharm.* xxiv. 325, 446; xxv. 297; also *Journ. de Chim. Méd.* iv. 2nde Sér. pp. 335, 432.

² *Journ. de Pharm.* xxiv. 445.

⁴ *Journ. de Chim. Méd.* iv. 405, 2e Sér.

³ *Ibid.* p. 438.

⁵ *Journ. de Pharm.* xxiv. 448.

[As a summary of the characters of good opium we subjoin the following paragraph, which we find among the author's notes:—

1. Treated with cold water, it ought to completely divide itself. The extractive matter should be dissolved, and the resinoid matter should be separated.

2. The liquor, which is at first turbid, should become clear by repose, and assume a more or less deep brown colour.

a. It should give a wine-red colour with persalts of iron (meconic acid).

b. It should give a whitish precipitate with chloride of calcium by the aid of heat (meconate and sulphate of lime). The supernatant liquor, filtrated and concentrated by evaporation, should deposit crystals of muriate of morphia.

c. It should give with ammonia dropped into the boiling liquor a precipitate, especially after cooling, consisting of coloured morphia mixed with resin, narcotine, and a little meconate of lime.

Some of the peculiar ingredients of opium are not discoverable in the infusion or decoction; such as narcotina, codeia, meconine, narceine, and thebaina.—En.]

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—The effects of opium on plants have been principally examined by Marcet¹ and Macaire.² The latter writer states that the stamens of the barberry (*Berberis vulgaris*) and the leaves of the sensitive plant lost their contractility, and soon died, when the stems of these vegetables were immersed in an aqueous solution of opium. But I have tried this experiment with a different result. I immersed a flowering stem of the barberry in water, to which the tincture of opium had been added. In thirty hours, I could not perceive any effect on the plant. The stamens, even in the overblown flowers, still retained their contractility. Charvet states that he watered a sensitive plant with a moderately strong infusion of opium forty-eight days, without affecting the irritability of the plant. By immersing a portion of *Chara* in a solution of opium the circulation of this plant becomes slower, is soon suspended, and is ultimately stopped.³

β. On Animals generally.—The operation of opium on animals has repeatedly been the subject of physiological investigation. An abstract of a considerable number of experiments made by various individuals has been published by Wibmer.⁴ The most complete and extended series of experiments is that made by Charvet⁵ on the different classes of animals, for the purpose of determining its comparative action. While on all it has been found to act as a poison, its effects are observed to vary somewhat, according to the degree of development of the nervous system.

In the *invertebrated animals* opium causes weakness or paralysis of the contractile tissues, with gradual sinking, and death. Thus, in the *polygastrica* and the *annelides*, it first accelerates the animal movements, but afterwards paralyzes them. Now, in the lower *invertebrata*, a central nervous apparatus is altogether wanting; while in the higher animals of this class it is not sufficiently developed to exercise that influence over the whole individual which we observe it to possess in the *vertebrated classes*.

In the *vertebrated animals*, we have a high development of the central organs of the nervous system, and a consequent increase in the number of symptoms caused by opium. Thus, in *fishes*, *amphibials*, and *reptiles*, we observe, in addition to the weakened and paralytic condition of the contractile tissues, convulsions. In fish, the convulsive contractions bend the body laterally; whereas, in the other *vertebrata*, the superior dorsal muscles are affected, and hence the head and tail are elevated. These differences obviously depend on the disposition of the muscles. Proceeding in the ascending order, we observe in *birds* and *mammals*, besides the paralysis and convulsions, stupor. The last-mentioned symptom, however, is principally manifested in the highest of the mammals, man; that is, in that animal which has the most highly developed brain; while, in some of the lower mammals, as the ruminants, it is scarcely observed; and even in the carnivora, as dogs, it is very slight. It is somewhat remarkable that the stupor is more manifest in birds

¹ *Ann. de Chim. et Phys.* xxix. 20.

² *Ibid.* xxxix. 213.

³ Meyen, *Report on the Progress of Vegetable Physiology during the year 1837*, translated by W. Francis, p. 14. Lond. 1839.

⁴ *Wirk. d. Arzneim. u. Gifte*, Bd. iv. S. 74, et seq.

⁵ *De l'Action comp. de l'Opium*, Paris, 1826.

than in the lower mammals. Moreover, it is not undeserving of notice that the operation of opium on the different races of man is not uniform. On the negro, the Malay, and the Javanese, it more frequently acts as an excitant, causing furious madness, or delirium and convulsions. Are we to ascribe the less frequent occurrence of these symptoms in the Caucasian variety to the greater development of his brain? In conclusion, then, it appears that the effects of opium on the animal kingdom have a relation to the degree of development and influence of the nervous system.

γ. *On Man*.—I propose to examine the effects of opium under three heads or subdivisions: *first*, the effects of one or a few doses employed medicinally; *secondly*, the effects of the habitual employment of opium, either by chewing or smoking it; and *thirdly*, its effects on the different systems of organs.

1. *Effects of one or a few doses*.—We may consider these under three degrees of operation.

First degree of operation.—In *small doses*, as from a quarter of a grain to one grain, opium generally acts as a stimulant, though in this respect the symptoms are not uniform. Usually, the vascular system is somewhat excited, and a sensation of fulness is experienced about the head. Dr. Crumpe¹ took one grain of opium when his pulse was at 70, and the alteration in the number of beats was as follows:—

In 2	5	10	15	20	25	30	35	40	45	50	55	60 minutes.
Pulse beat 70	74	76	76	74	74	74	72	72	70	70	70	70

The excitement in the cerebral vascular system is accompanied by alterations in the condition of the nervous functions. The mind is usually exhilarated; the ideas flow more quickly; a pleasurable or comfortable condition of the whole system is experienced, difficult to describe; there is a capability of greater exertion than usual. These symptoms are followed by a diminution of muscular power, and of susceptibility to the impression of external objects; a desire of repose is experienced, with a tendency to sleep. While these effects are taking place, the mouth and throat become dry, and hunger is diminished, though the thirst is increased; and slight constipation usually follows. Such are the ordinary effects of a small dose of opium on persons unaccustomed to its use. By repetition, however, its influence becomes considerably diminished; and those, therefore, who resort to it for the purpose of producing a pleasurable excitement, are obliged to augment the dose to keep up an equal effect.

Second degree of operation.—Given in a *full medicinal* dose (as from two to four grains), the stage of excitement is soon followed by that of depression. The pulse, which at first is increased in fulness and frequency, is afterwards reduced below the natural standard. The effect of two grains and a half on Dr. Crumpe (when his pulse was beating at 70) was as follows:—²

In 5	10	15	20	25	30	35	40	45	50	55	60	75	90 minutes.
Pulse beat 74	74	74	76	78	80	72	70	64	64	66	70	70	70

The skin becomes hot; the mouth and throat dry; the appetite diminished; the thirst increased; and frequently nausea, or even vomiting, is induced. The symptoms of excitement soon pass away, and a state of torpor succeeds; the individual seems indisposed to exertion; the muscular system appears enfeebled; the force of external impressions on the organs of the senses is diminished; and the ideas become confused. This state is followed by an almost irresistible desire of sleep, which is frequently attended by dreams—sometimes of a pleasing, at others of a

¹ *Inq. into the Nat. and Prop. of Opium*, p. 33, 1793.

² *Op. supra cit.* p. 85.

frightful nature. These effects are usually succeeded by constipation (which may continue for several days), by nausea, furred tongue, headache, and listlessness.

Third degree of operation; poisonous effects of opium.—Dr. Christison has so briefly summed up the effects of a poisonous dose of opium, that I cannot do better than quote his statement: "The symptoms of poisoning with opium, when it is administered at once in a dangerous dose, begin with giddiness and stupor, generally without any previous stimulus. The stupor rapidly increasing, the person becomes motionless and insensible to external impressions; he breathes very slowly, generally lies quite still, with his eyes shut and the pupils contracted; and the whole expression of the countenance is that of a deep and perfect repose. As the poisoning advances, the features become ghastly, the pulse feeble and imperceptible, the muscles exceedingly relaxed, and, unless assistance is speedily procured, death ensues. If the person recovers, the sopor is succeeded by prolonged sleep, which commonly ends in twenty-four or thirty-six hours, and is followed by nausea, vomiting, giddiness, and loathing of food."

2. *Habitual use of Opium.*—Of those who habitually employ opium as an intoxicant, some chew or eat it; others smoke it.

Opium-eating.—The ill effects of opium-eating have been described by most travellers in Turkey and Persia, where this practice is carried to a greater extent than in any other part of the world. In the writings of Dr. Russell,¹ Chardin,² the Baron de Tott,³ Pouqueville,⁴ and Madden,⁵ will be found notices of these effects. The following extract is from one of the latest accounts, that of Dr. Oppenheim:—⁶

"The causes leading to the use of opium are many, and among them may be reckoned the following: long-continued diarrhœa, as a remedy for which opium is used in the first instance, and its use afterwards continued from habit; chronic coughs, in which opium is also used as a popular remedy; habitual drunkards also frequently have recourse to opium as a new stimulus, after they have abjured wine in some fit of repentance. Persons holding high offices or dignities in the state have also recourse to opium, when the preservation of their character forbids them the use of wine; some very strict believers also take opium as a restorative in cases of great exertion, as the *Tartars* (couriers), who travel with astonishing celerity. Opium-eaters generally begin with doses of from half a grain to two grains, and gradually increase the quantity till it amounts to two drachms, and sometimes more, a day; they usually take the opium in pills, but avoid drinking any water after having swallowed them, as this is said to produce violent colic; to make it more palatable, it is sometimes mixed with syrups or thickened juices; but in this form it is less intoxicating, and resembles mead; it is then taken with a spoon, or is dried in small cakes with the words *Mash Allah*, the "work of God," imprinted on them. The effect of the opium manifests itself one or two hours after it has been taken, and lasts for five or six hours, according to the dose taken and the idiosyncrasy of the subject. In persons accustomed to take it, it produces a high degree of animation, which the *Theriaki* (opium-eaters) represent as the acmé of happiness.

"The habitual opium-eater is instantly recognized by his appearance. A total attenuation of body, a withered, yellow countenance, a lame gait, a bending of the spine, frequently to such a degree as to assume a circular form, and glossy, deep sunken eyes, betray him at the first glance. The digestive organs are in the highest degree disturbed, the sufferer eats scarcely anything, and has hardly one evacuation in a week; his mental and bodily powers are destroyed, he is impotent. By degrees, as the habit becomes more confirmed, his strength continues decreasing, the craving for the stimulus becomes even greater, and, to produce the desired effect, the dose must constantly be augmented. When the dose of two or three drachms a day no longer produces the beatific intoxication so eagerly sought by the Opiophagi, they mix the opium with [corrosive] sublimate, increasing the quantity till it reaches to ten grains a day; it then acts as a stimulant. After long indulgence the opium eater becomes subject to nervous or neuralgic pains, to which opium itself brings no relief. These people seldom attain the age of forty, if they have begun to use opium at an early age. The fasts in the month of Ramasan are for them fraught with the most dreadful tortures, as during the whole of that month they are not allowed to take anything during the day. It is said that, to assuage their sufferings, they swallow before the morning prayer, besides the usual dose, a certain number of other doses, each wrapped up in its particular paper, having previously calculated the time when each

¹ Nat. Hist. of Aleppo, i. 126, 1791.

² Mém. sur les Turcs et les Tart. 1785.

³ Travels in Turkey, &c. vol. i. p. 23, 1829.

⁴ Ueber d. Zust. d. Heilk. u. über d. Volkskrankh. in d. Europ. u. Asiat.-Turkei. Hamb. 1838. Also Brit.

and For. Med. Rev. vol. iv. p. 394.

⁵ Voy. en Perse et autres Lieux de l'Orient.

⁶ Voy. en Morée, en Constant. t. ii. p. 123, 1805.

envelop shall be unfolded, and allow the pill to produce the effects of their usual allowance. When this baneful habit has become confirmed, it is almost impossible to break it off; the torments of the opium-eater, when deprived of this stimulant, are as dreadful as his bliss is complete when he has taken it; to him, night brings the torments of hell; day, the bliss of paradise. Those who do make the attempt to discontinue the use of opium, usually mix it with wax, and daily diminishing the quantity of the opium, the pill at last contains nothing but wax."

For an account of the effects produced on English opium-eaters, I may refer to the well-known confessions of Mr. De Quincey,¹ and of the late Mr. S. T. Coleridge.² Numerous instances of the enormous quantities of opium which, by habit, may be taken with impunity, have been published. Dr. Chapman³ tells us that he knew a wineglassful of laudanum to be given several times in twenty-four hours. "But what is still more extraordinary," says this author, "in a case of cancer of the uterus, which was under the care of two highly respectable physicians (Drs. Monges and La Roche) of Philadelphia, the quantity of laudanum was gradually increased to three pints, besides a considerable quantity of solid opium in the same period." Pinel mentions a lady who required 120 grains of opium to give her ease in cancer of the uterus.

Some doubt has been entertained as to the alleged injurious effects of opium-eating on the health, and its tendency to shorten life; and it must be confessed that in several known cases which have occurred in this country no ill effects have been observable. Dr. Christison⁴ has given abstracts of eleven cases, the general result of whose histories "would rather tend to throw doubt over the popular opinion." A few years ago, a Life-Assurance Company, acting on this general opinion, resisted payment of a sum of money, on the ground that the insurer (the late Earl of Mar) had concealed from them a habit which tends to shorten life. But the case was ultimately compromised. Dr. Burnes⁵ asserts that the natives of Cutch do not suffer much from opium-eating.

In those cases of disease (usually cancerous) in which enormous doses of opium are taken to alleviate pain, I have usually observed constipation produced; but Dr. Christison says, "constipation is by no means a general effect of the continued use of opium. In some of the cases mentioned above, no laxatives have been required; in others, a gentle laxative once a week is sufficient."

In 1841, an opium-eater, aged 26, was admitted into the London Hospital. He was accustomed to take two or two and a half drachms of solid opium daily. He originally began its use to relieve the attacks of angina pectoris. He was now most anxious to leave off this habit; though the difficulty of doing so was extreme. It did not diminish, but, according to his assertion, augmented his appetite; for, after each dose, he ate voraciously. At first, when he commenced its use, it caused dryness of the mouth and throat, and constipation, but latterly his bowels were regular, as before he commenced the use of this drug. His pulse ranged from 88 to 96. His urine was somewhat less than natural. The condition of his skin varied; in general it was dry, but occasionally was covered with profuse perspiration. He described the effect of the opium on his mental faculties as those of calmness, comfort, and serenity. Under its use he was able to support great bodily and mental fatigue. He never experienced the exhilarating and pleasurable sensations described by De Quincey. His feelings, when not under the influence of opium, were most distressing. Mr. Davies (an intelligent pupil) described his condition at this time as follows: Eyes hollow, dark, and sunken; features haggard; hands trembling; voice and manner anxious; mouth parched; appetite wanting; sleeplessness. Unable to sleep for want of his accustomed dose, he used to pace the ward of the hospital at night almost frantic, though quite sensible of his miserable condition, and anxious to abandon the practice.

[There is great reason to believe that the practice of opium-eating is very common in this country among the lower as well as the middle classes. The consumption of opium is very great, and wholly disproportioned to the quantity required for medicinal purposes. From an official report just published (July, 1853), it appears that during the last five months the enormous quantity of 63,354 lbs. of opium have been imported into this country; the quantity for the last month was 9,699 lbs.—Ed.]

Opium-smoking.—I have already referred to the enormous quantities of opium

¹ *Confessions of an English Opium-eater.*

² *Cottle's Early Recollect. of the late S. T. Coleridge*, vol. ii. p. 149, et seq. Lond. 1837.

³ *Elem. of Therap.* ii. 199.

⁴ *Sketch of Hist. of Cutch*, p. 9, Edinb. 1839.

⁵ *Treat. on Poisons.*

consumed in China and the islands of the Indian Archipelago by smoking. The *smokable extract*, called *chandoo*, is made into pills about the size of a pea. "One of these being put into the small tube that projects from the side of the opium-pipe, that tube is applied to a lamp, and the pill being lighted, is consumed at one whiff or inflation of the lungs, attended with a whistling noise. The smoke is never emitted by the mouth, but usually receives vent through the nostrils, and sometimes, by adepts, through the passage of the ears and eyes."¹ The residue in the pipe is called *Tyechandoo*, or fecal opium, and is used by poor persons and servants.

The mode of using the pipe has been depicted by Mr. Davies.² Some details respecting the mode of smoking opium have been given by Dr. Hill.³

In the first edition of this work, I stated that though the immoderate practice of opium-smoking must be highly detrimental to health, yet that I believed the statements of Medhurst,⁴ and others, applied to cases in which this practice was carried to excess; and I observed that an account of the effects of opium-smoking by an unbiased and professional witness was a desideratum. My opinion was founded on the statements of Botta⁵ and Marsden.⁶ The latter, a most accurate writer, observes that "the *Limun* and *Batang Assei* gold-traders, who are an active and laborious class of men, but yet indulge as freely in opium as any others whatever, are, notwithstanding, the most healthy and vigorous people to be met with on the island." This desideratum has been recently supplied by Mr. Smith,⁷ surgeon, of Pulo Penang, whose statements fully confirm my opinion. For though the practice is most destructive to those who live in poverty and distress, and who carry it to excess, yet it does not appear that the Chinese, in easy circumstances, and who have the comforts of life about them, are materially affected in respect to longevity, by the private addiction to this vice. "There are many persons," observes Mr. Smith, "within my own observation, who have attained the age of sixty, seventy, or more, and who are well known as habitual opium-smokers for more than thirty years past."

The first effect of this drug on the Chinese smokers is to render them more loquacious and animated. Gradually, the conversation drops, laughter is occasionally produced by the most trifling causes, and to these effects succeed vacancy of countenance, pallor, shrinking of the features, so that the smokers resemble people convalescing from fever, followed by deep sleep for half an hour to three or four hours. An inordinate quantity causes headache, vertigo, and nausea. The Malays are rendered outrageous and quarrelsome by the opium-pipe.

It is extremely difficult to discontinue the vice of opium-smoking, yet there are many instances of its being done. The continuance of this destructive practice deteriorates the physical constitution and moral character of the individual, especially among the lower classes. Its powerful effects on the system are manifested by stupor, forgetfulness, deterioration of the mental faculties, emaciation, debility, sallow complexion, lividity of lips and eyelids, languor and lacklustre of the eye, appetite either destroyed or depraved, sweetmeats or sugar-cane being the articles that are most relished. "In the morning, these creatures have a most wretched appearance, evincing no symptoms of being refreshed or invigorated by sleep, however profound. There is a remarkable dryness or burning in the throat, which urges them to repeat the opium-smoking. If the dose be not taken at the usual time, there is great prostration, vertigo, torpor, discharge of water from the eyes, and in some an involuntary discharge of semen, even when wide awake. If the privation be complete, a still more formidable train of phenomena takes place. Coldness is felt over the whole body, with aching pains in all parts. Diarrhoea occurs; the most horrid feelings of wretchedness come on; and, if the poison be withheld,

¹ Marsden, *Hist. of Sumatra*, 3d ed. p. 278.

² *The Times* newspaper for Dec. 3, 1841.

³ *Forster's Notizen*, xxvi.

⁴ *Lancet*, February 19, 1842.

⁵ *The Chinese*, vol. ii. p. 459.

⁶ *China*, 1838.

⁷ *Op. supra cit.* p. 278.

death terminates the victim's existence." The offspring of opium-smokers are weak, stunted, and decrepit.

[Dr. Eatwell's paper on opium contains some remarks on the subject of opium-smoking, which we here subjoin.—ED.]

"It has been too much the practice with narrators, who have treated on the subject, to content themselves with drawing the sad picture of the confirmed opium debauchee, plunged in the last state of moral and physical exhaustion, and having formed the premises of their argument of this exception, to proceed at once to involve the whole practice in one sweeping condemnation. But this is not the way in which the subject can be treated; as rational would it be to paint the horrors of delirium tremens, and upon the evidence to condemn at once the entire use of alcoholic liquors. The question for determination is, not what are the effects of opium used to excess, but what are its effects on the moral and physical constitution of the mass of the individuals who use it habitually, and in *moderation*, either as a stimulant to sustain the frame under fatigue, or as a restorative and sedative after labour, bodily or mental. Having passed three years in China, I may be allowed to state the results of my observation; and I can affirm, thus far, that the effects of the abuse of the drug do not come very frequently under observation; and that, when cases do occur, the habit is very frequently found to have been induced by the presence of some painful chronic disease, to escape from the sufferings of which the patient has fled to this resource. That this is not always the cause, however, I am perfectly ready to admit; and there are, doubtless, many who indulge in the habit to a pernicious extent, led by the same morbid impulses which induce men to become drunkards in even the most civilized countries; but these cases do not at all events come before the public eye. It requires no laborious research in civilized England to discover evidences of the pernicious effects of the abuse of alcoholic liquors; our open and thronged gin palaces, and our streets, afford abundant testimony on the subject; but in China this open evidence of the evil effects of opium is at least wanting. As regards the effects of the habitual use of the drug on the *mass* of the people, I must affirm that no injurious results are visible. The people generally are a muscular and well-formed race, the labouring portion being capable of great and prolonged exertion under a fierce sun, in an unhealthy climate. Their disposition is cheerful and peaceful, and quarrels and brawls are rarely heard amongst even the lower orders; whilst in general intelligence they rank deservedly high amongst orientals. Proofs are still wanting to show that the moderate use of opium produces more pernicious effects upon the constitution than does the moderate use of spirituous liquors, whilst at the same time it is certain that the consequences of the abuse of the former are less appalling in their effects upon the victim, and less disastrous to society at large, than are the consequences of the abuse of the latter. Compare the furious madman, the subject of delirium tremens, with the prostrate debauchee, the victim of opium; the violent drunkard with the dreaming sensualist intoxicated with opium; the latter is at least harmless to all except to his wretched self, whilst the former is but too frequently a dangerous nuisance, and an openly bad example to the community at large."

4. *Action of Opium on the Different Organs.*—In discussing this subject, it will be convenient to consider the organs arranged in groups or systems devoted to some common functions.

a. *On the Cerebro-spinal System.*—Taken in small or moderate doses, opium first produces excitement of the vascular system of the brain, accompanied with corresponding excitement in the cerebro-spinal functions, as already stated. This state, however, is succeeded by that of depression. The effect of opium-eating and opium-smoking on the intellectual faculties has been already described. In large or poisonous doses the leading symptom is sopor; that is, a state analogous to profound sleep, from which the patient *can* be roused, though with difficulty. In the latter stage of poisoning this symptom is succeeded by coma—that is, profound sleep, from which the patient *cannot* be roused. Sopor is usually accompanied either with actual paralysis of the muscular fibres, or with a diminished power almost amounting to it; both of which states doubtless arise from the same condition of the cerebro-spinal system which produces sopor or coma. This state is usually supposed to be sanguineous (venous) congestion. The pupil is usually contracted—a circumstance deserving of especial notice. In some cases there is delirium in the place of sopor or coma, and convulsions instead of paralysis. These are to be regarded as exceptions to the general rule, and are accounted for, pathologically, by supposing that they depend on a state of irritation or excitement set up in the nervous centres, and which usually, though not invariably, terminates in congestion. Another effect of opium is diminished sensibility. Thus, the whole body becomes less susceptible

of painful impressions; in dangerous and fatal cases, the eyes are insensible to light—the ears to sound. This state has been accounted for by supposing that the functions of the sensitive nerves are diminished or suspended by the congested condition of the brain.

From these effects of opium on the cerebro-spinal system the following inferences may be drawn:—

1. That it is an objectionable agent in apoplexy, phrenitis, and paralysis.¹
2. That under proper regulations it is a remedy which may be used to stimulate the cerebro-vascular system, to promote sleep, to diminish inordinate muscular contraction, to diminish the sensibility of the body, and thereby to alleviate pain.

3. *On the Digestive System.*—The usual effects of opium on the organs of digestion are the following: It diminishes secretion and exhalation from the whole canal; thus it causes dryness of the mouth and throat, and diminishes the liquidity of the stools; it excites thirst, lessens hunger, checks the digestive process (for in some animals poisoned by opium, food which they had taken previously has been found in the stomach unchanged); and in some cases it excites vomiting. Mr. Kerr² tells us that, in the famine which prevailed in the East Indies in the year 1770, opium was purchased by the unhappy sufferers, at extraordinary prices, to allay the cravings of hunger, and to banish the dreadful prospect of death. The Tartar couriers, who travel immense distances in a short period of time, take opium only during the journey, to support them. It diminishes the sensibility and contractility of the digestive organs; hence the difficulty, in severe cases of poisoning, of producing vomiting. The constipation which follows the use of opium depends partly on the same cause, and in part also on the diminished excretion of bile, and diminished secretion from the gastro-intestinal mucous membrane. Sprögel³ found the choledic ducts of animals, to which opium had been given, filled with bile; yet it had not passed into the intestines, for the feces were scarcely tinged by it, but had the appearance which we observe them to have in jaundiced patients.

From these effects of opium on the digestive organs, we may draw the following inferences:—

1. That in diminished secretion from the gastro-intestinal membrane, in extreme thirst, in loss of appetite and weak digestion, in obstinate costiveness, and in diminished excretion of bile, opium is an objectionable remedy.

2. That under proper regulations opium is an admissible remedy for the following purposes: To diminish excessive hunger; to allay pain, when unaccompanied by inflammation; to diminish the sensibility of the digestive organs, in cases of acrid poisoning, and in the passage of biliary calculi; to produce relaxation of the muscular fibres of the alimentary canal (in colic and diarrhœa), and of the gall-ducts (in the passage of calculi), and to diminish excessive secretion from the intestinal canal, in diarrhœa.

By continued use (as by opium-eaters) this drug frequently ceases to cause dryness of the mouth, to pall the appetite, or to confine the bowels, as I have already mentioned.

- γ. *On the Vascular System.*—Opium certainly influences the movements of the heart and arteries; but the effect is by no means uniform, since in some cases we see the pulse increased, in others diminished in frequency; and a like variation is noticed in its fullness. Moreover, these variations occur in the same case at different stages. From Dr. Crumpe's experiments, before referred to, it appears that, after the use of a moderate dose of opium, the frequency of the pulse is first increased, and then decreased. The diameter of the artery, and the force and regularity with which the pulsations are effected, are properties of the pulse, readily, but by no means uniformly, affected by opium. To a certain extent we perceive a

¹ [We subjoin a note by the author in reference to the contraindications for the use of opium in certain forms of hysteria.—ED.] I have seen, in two cases, serious effects follow the use of small doses of opium in hysteria. Both patients were females at or about the age of twenty, weak and thin, and subject to hysteria. In the first, there was insensibility apparently of an hysterical kind. The patient had several fits. On her recovery from these she complained of headache, and there was great irritability. Only one grain of opium was administered, but this caused sopor and death.

² *Med. Obs. and Inq.* vol. v. p. 321.

³ Quoted by Christen, *Opium hist. chem. and pharm. invest.* p. 66, 1820.

relation between the condition of the pulse and that of the cerebro-spinal functions. Thus, when convulsions occur, we usually have a hurried pulse—whereas, when sopor or coma supervenes, the pulse becomes slower or weaker, or both, than natural. But these conditions are by no means uniform. A frequent pulse, with a feverish condition of the body, are common consequences of the use of small or moderate doses of opium; and in poisoning by this drug, a quick pulse, even though no convulsive movements are observed, is by no means rare. A poisonous dose of opium usually enfeebles the pulse, sometimes makes it fuller, often renders it irregular, and towards death always renders it feeble, and often imperceptible. We can easily believe that the muscular fibres of the heart must experience, from the use of a large dose of opium, a diminution of power in common with other muscular fibres, and hence the contractions become weaker. It is also probable that the contractile coat of the arteries and capillaries equally suffers. Now Wirtensohn¹ supposes that the fullness of the pulse sometimes observed in poisoning by opium, arises from the insufficient power of the heart to propel the blood through this paralyzed or weakened capillary system. The accumulation of blood observed in the large venous trunks and cavities of the right side of the heart is supposed to arise from the obstruction experienced to its passage through the pulmonary vessels.

In attempting to lay down indications and contraindications for the use of opium as a remedy for morbid conditions of the circulation, two difficulties present themselves: *first*, the same condition of the vascular system may be induced by various and even opposite causes, for some of which opium may be an appropriate remedy, while for others it may prove an injurious agent; *secondly*, the effects of opium on the circulation are not uniform, and hence not to be relied on. The following conclusions, therefore, are submitted with considerable hesitation as to the universality of their application:—

1. That in increased activity of the vascular system with considerable power, or with diminished secretions and exhalations, and in morbid conditions of the vascular system with a tendency to sopor or coma, opium is an objectionable remedy.

2. That in vascular excitement with great diminution of power, as after hemorrhage, and in various morbid conditions of the pulse attended with acute pain, spasm, or profuse secretion and exhalation, but without visceral inflammation, opium often proves a serviceable agent.

3. *On the Respiratory System.*—In studying the effects of opium on the respiration, we must remember that the mechanical part of this function is effected by muscular agency; and as the contractility of the muscular fibre is powerfully influenced by opium, so the respiratory movements are also necessarily modified. Occasionally, the primary effect is a slight increase in their frequency; but the secondary effect is almost always of an opposite kind, the respiration being slower than usual; and when coma is present, the breathing is usually gentle, so as scarcely to be perceived; but in some cases it is stertorous. In fact, a paralytic condition of the respiratory muscles takes place, in consequence of which inspiration becomes gradually more and more difficult, until eventually asphyxia is induced, which is usually the immediate cause of death. Another effect ascribed to opium is, that it checks the arterialization of the blood, by diminishing the supply of nervous agency, without which the decarbonization or oxygenization of this fluid cannot take place. It is difficult, however, to distinguish the consequences of this effect from those of asphyxia produced by paralysis of the respiratory muscles.

The third point of view under which we have to examine the influence of opium on the respiratory system is, its effect on the membrane lining the trachea and bronchial tubes and cells. In the first place, it diminishes the sensibility of this, in common with other parts of the body; and, secondly, it checks exhalation and mucous secretion.

A knowledge of these effects of opium on the organs of respiration leads to the following conclusions:—

1. That this agent is contraindicated in difficulty of breathing arising from a deficient supply of nervous energy, as in apoplectic cases; that it is improper where the venous is imperfectly converted into arterial blood; and, lastly, that it is improper in the first stage of catarrh and

¹ Quoted by Barbier, *Traité Élém. de Mat. Méd.* t. ii. 2me éd.

peripneumony, both from its checking secretion, and from its influence over the process of arterialization.

2. That in cases of poisoning by opium, artificial respiration is indicated to prevent asphyxia.

3. That opium may, under proper regulations, be useful to diminish the contractility of the muscles of respiration, or of the muscular fibres of the air-tubes, as in spasmodic asthma; to diminish the sensibility of the bronchia, in the second stage of catarrh, and thereby to allay cough by lessening the influence of the cold air; and lastly, to counteract excessive bronchial secretion.

ε. *On the Urinary System.*—Authors are not agreed as to the effect of opium on the kidneys; some asserting that it increases, others that it diminishes, the quantity of urine secreted. Thus, Dr. Michaelis¹ asserts that, in giving opium in venereal cases, he has sometimes found the secretion of urine exceeding in quantity all the fluids drank. It cannot, however, be doubted that in most cases a moderate quantity of opium diminishes the excretion, while at the same time it makes this fluid turbid and thick. This does not, however, prove that the kidneys are the parts affected. Sprægel² tells us, that when he gave two scruples of opium to dogs, no urine was passed for two days; and, under the influence of two drachms of this medicine, the urine was retained for three days. But dissection showed that the kidneys had not ceased to secrete urine, since the bladder was found distended with this secretion, and its parietes without the least sign of contractility on the application of nitric acid; so that it would appear the non-evacuation of the urine was referable to the insensible and paralyzed condition of the vesical coats, and not to the diminished urinary secretion. Charvet³ has also noticed in dogs, cats, and hares, that the urinary bladder was distended. As, however, in man, opium usually increases the cutaneous exhalation, while in other mammals this effect was not observed, we must be careful in transferring our conclusions with respect to the influence of opium on one order of animals to another order. But I ought to add that Welper, of Berlin, always found the bladder filled with urine both in man and animals. In some morbid conditions of system, opium certainly checks the urinary secretion. This is decidedly the case in diabetes.⁴

The ureters and bladder have their sensibility and contractility diminished by opium. With respect to the effect on the first of these parts, the statement seems proved by the well-known beneficial influence of opium in cases where calculi are descending along these tubes. The acute pain is frequently relieved, and the ureters relaxed, so that large calculi are sometimes allowed to descend from the kidneys along them.

Besides the observations of Sprægel, before referred to, we have other evidence of the paralyzing and benumbing effect of opium on the bladder. In some cases of poisoning by this substance the bladder has been found to be unable to contract on its contents. In some other instances the sphincter of the bladder has been paralyzed, and in consequence the urine was voided involuntarily.⁵ Barbier has also noticed the same thing, and quotes the experience of Dr. Bally to the same effect. The effect of morphia on the bladder is more marked than that of opium.

These remarks on the effects of opium on the urinary organs lead to the following conclusions:—

1. That in diminished sensibility or contractility, or both, of the ureters or bladder, the use of opium is objectionable.

2. That, under proper regulations, opium may be a valuable remedy to dull the sensibility of the pelvis of the kidney, in cases of renal calculi; to allay pain and produce relaxation of the ureters when calculi are passing along these tubes; and, lastly, to diminish irritation of the bladder, whether produced by cantharides or other causes.

ζ. *On the Sexual System.* aa. *Of Men.*—Opium has long been celebrated as an aphrodisiac; and we are told that the Japanese, Chinese, Indians, Persians, Egyptians, and Turks, use it as such. Among other symptoms of excitement pro-

¹ *Med. Comm.* i. p. 307, 1784.

² *Op. supra cit.* p. 221.

³ Prout, *Inq. into the Nat. and Treat. of Affect. of the Urin. Org.* p. 74, 2d ed.

⁴ See *Lond. Med. and Phys. Journ.* xxviii. 60; xxxi. 193; and *Lond. Med. Rev.* for 1811, p. 371.

⁵ Cited by Christen, *op. supra cit.* p. 68.

duced by the habitual use of large doses of opium, it is not improbable that there may be a heightened condition of the venereal feelings, in consequence of an increased determination of blood to that part of the brain supposed to be devoted to the sexual function, which part the phrenologists assert to be the cerebellum. Moreover, it is said to produce erection; and in support of this statement the following strange story is told: "Turcæ ad Levenzinum, 1664, contra Comitum Lud. Souches pugnantes, opio exaltati, turpiter cæsi et octo mille numero occisi mentulas rigidas tulere."¹ Cabanis² adopts this story, and ascribes the above-mentioned condition to the convulsive movements, which affect the body *in articulo mortis*, and not to an aphrodisiac operation. The effect alluded to, if it really does take place, is probably to be referred to the accumulation of blood in the erectile tissues, arising from a disordered state of the circulation. Impotence is ascribed by some to opium-eating, and is a more probable effect. I am unacquainted with any facts on which to ground any well-founded opinion as to the power of opium to diminish or increase the spermatie secretion.

β3. *Of Women*.—We have little positive information as to the effects of opium on the reproductive organs of women. It is said that the catamenia, lochia, and secretion of milk are unaffected by it, but that it causes intumescence of the nipples. Under its use the milk acquires a narcotic property. Farthermore, at times, it has appeared to have an injurious effect on the fœtus *in utero*.³ Opium appears to act on the uterus as on most other contractile parts of the body; that is, it diminishes the contractility and sensibility of this viscus.

From these observations it follows:—

1. That wet-nurses and pregnant women must employ opium with great caution, as its use by them may endanger the life of the child.

2. That opium may be employed to allay pain, spasm, and morbid irritation of the sexual organs in either sex; and that its use in the female is not likely to be attended with retention of the uterine or mammary secretions.

3. That the influence of opium on the venereal appetite is not sufficiently and satisfactorily determined to permit us to make any practical application of it.

γ. *On the Cutaneous System*.—Considered as an organ of sense, the cutaneous system is affected by opium in an analogous way to the other organs of sense; that is, its sensibility is diminished. But the skin has another function—that of excretion, and which does not appear to be at all diminished, nay, to be increased, by the use of opium; one of the usual effects of this medicine being perspiration, which is in some cases attended with a prickling or itching of the skin, and occasionally with an eruption. In fact, taken medicinally, opium is a powerful sudorific, and often proves so even when acting as a poison. "In a fatal case, which I examined judicially," says Dr. Christison, "the sheets were completely soaked to a considerable distance round the body."

From these remarks it follows:—

1. That opium is not likely to relieve loss of feeling or excessive perspiration; but may, on the other hand, under some conditions of the system, prove injurious.

2. That opium is adapted to the relief of pain or excessive sensibility of the skin, and for provoking perspiration; but the propriety of its use for these purposes must be determined by reference to the condition of the system generally. Experience proves that when the skin is very hot, and especially if it be also dry, opium is seldom beneficial, but often hurtful.

δ. *Topical Effects*.—The local effects of opium are, compared with the general effects, very slight. Applied to the eye, the internal membrane of the nose, urethra, cutis vera, wounds or ulcers, it first causes pain, a sense of heat, and inflammation; but these effects subside, and are followed by a weakened or a paralytic condition of the sensitive and motor nerves. Several physiologists have proved that opium causes a local paralysis of the nerves; and Muller⁴ has shown that the narcotic action is not propagated from the trunk of a nerve to its branches. Crumpe⁵ showed that, at the end of thirty minutes, the eye to which opium had been applied was

¹ Christien, *op. supra cit.* p. 53.

² F. H. Ramsbotham, *Lond. Med. Gaz.* vol. xiv. p. 84.

³ *Op. supra cit.*

⁴ *Rapp. de Phys. et du Morale de l'Homme.*

⁵ *Phys. by Baly*, vol. i. p. 630.

somewhat less susceptible of the action of alcohol. Scarcely any obvious effect results from the application of opium to the ordinary integument, on account of the barrier presented by the cuticle. Employed endermically the effects are much more powerful.

POST-MORTEM APPEARANCES.—The most important appearances are those observed in the nervous system; such as turgescence of vessels, effusion of water or of coagulable lymph, and occasionally, though rarely, extravasation of blood.

Whenever redness of the digestive canal is observed, I believe it is referable to the use of some irritants (such as spirits, ammonia, or emetics) taken either with or after the use of opium.

MODUS OPERANDI.—Under this head, I propose to examine several points not hitherto noticed, which involve the theory of the operation of opium on the system.

1. *The Odorous and Active Principles of Opium are absorbed.*—This assertion is proved by the following facts:—

a. The odour of opium is sometimes recognizable in the secretions and exhalations; thus, it is well known that the opiate odour is frequently detected in the breath of persons poisoned by this drug; and Barbier¹ states it may be also noticed in the urine and sweat.

b. The secretions, in some cases, appear to possess narcotic properties. Barbier mentions the case of an infant who was thrown into a state of narcotism of several hours' duration, in consequence of having sucked a nurse who had previously swallowed a dose of laudanum to relieve a cramp of the stomach.

γ. Barruel asserts that he detected morphia in the blood and urine² of a person under the influence of a poisonous dose of laudanum. As, however, these results have not been obtained by Dublanc or Lassaigue, the statement is not to be absolutely relied on.

2. *The Constitutional Effects of Opium depend in great part, if not wholly, on the absorption of its active principles.*—The facts on which this assumption rests are:—

a. The active principles of opium are absorbed.

b. The constitutional effects of it are found to be proportionate to the absorbing powers of the part.

γ. The effect of opium, when thrown into the jugular vein, is similar to, though more powerful than that produced by its application to other parts of the body.

δ. "The narcotic action does not react from a particular point of a nerve on the brain."³

3. *The Essential and Primary Operation of Opium is on the Nervous System (the Brain and Spinal Cord chiefly).*—This axiom is proved by reference to the already-described effects of opium. An examination of them shows that—

a. The most important effects of opium are direct and obvious lesions of the nervous functions.

b. The other effects of opium appear, for the most part, to be secondary; that is, they arise out of the nervous lesions just referred to.

4. *Opium acts on the Nervous System as an Alterative.*—There are but three kinds of changes, compatible with life, which medicines can effect in the vital actions of an organ; viz. an increase, a diminution, or an alteration of activity. A change in the intensity or energy merely of the vital actions of the nervous system would not give a satisfactory explanation of the effects of opium. We are obliged, therefore, to assume that opium changes the quality of the actions. This is what is meant by the term *alterative*.

The inquiry into the nature and kind of influence exercised by opium over the system, presents an extensive field for speculation and hypothesis. Galen⁴ declared opium to be cold in the fourth degree, and his authority long prevailed in the schools. It was first opposed by the *iatro-chemists*, who declared opium to be of a hot nature⁵. Some, however, adopted a middle course, and asserted that it possessed both hot and cold particles.⁶ The *iatro-mechanists* endeavoured to explain the operation of opium on mechanical principles. By some, expansion, by others condensation of the blood, was supposed to be produced by the mechanical properties of

¹ *Traité Élém. de Mat. Méd.* ii. 732, 2d ed.

² On one occasion I at first supposed that I had detected morphia and meconic acid in the urine of a man poisoned by opium; for both nitric acid and the sesquisalts of iron gave a red colour to this secretion. I have since found, however, that the urine of healthy individuals often yields the same results.

³ Müller, *Phys.* by Baly, i. 631.

⁴ Wedelius, *Opiologia*, cap. vi. p. 26, 1692.

⁵ *De Simpl. Med. Facult.* lib. viii.

⁶ See Crumpe, *op. supra cit.* p. 91.

the opiate particles acting on the nerves.¹ Dr. Cullen² considered opium to be a sedative, and referred its effects to its power of "diminishing the mobility and in a certain manner suspending the motion of the nervous fluid." Several later writers, Barbier,³ for example, also call opium a sedative. Brown⁴ declared it to be a stimulant, and his opinion has been adopted by Crumpe,⁵ Murray,⁶ and Dr. A. T. Thomson,⁷ in this country, and of course by the continental Brunonian, as well as by the partisans of the Italian theory of contra-stimulus.⁸ Fontana⁹ ascribed the operation of opium to changes which it induces in the blood. Mayer¹⁰ declared opium to be both stimulant and sedative; viz. stimulant to the nerves and vascular system, but sedative to the muscles and digestive organs. Lastly, Orfila¹¹ asserts that "opium, employed in strong doses, ought not to be ranked among the narcotics or the stimulants; it exerts a peculiar mode of action, which cannot be designated by any of the terms at this moment employed in the *Materia Medica*." These examples, selected out of many opinions, will be sufficient to prove how little is really known of the real action of opium; and I believe we shall save ourselves much time and useless speculation by at once confessing our ignorance on this point.

5. *The operation of Opium, compared with that of other cerebro-spinants or narcotics, is distinguished by both positive and negative characteristics.*—The symptoms constituting the *positive* characters are relaxation or paralysis of the contractile tissues, a tendency to sleep or stupor, a contracted pupil, and constipation. The symptoms whose absence furnishes the *negative* characters, are tetanic convulsions, delirium or inebriation, dilated pupil, syncope, gastro-intestinal irritation, and topical numbness.

These are the general characteristics of the opiate medication. To some of them, occasional or perhaps frequent exceptions exist.

I have already pointed out the distinguishing effects of hyoscyamus, belladonna, and stramonium. The topical numbness caused by aconite distinguishes its operation from that of opium. Moreover, in three cases of poisoning by this substance, which came under my notice, there was no stupor. Tobacco and foxglove enfeeble the vascular system, causing syncope; and they also produce gastro-intestinal irritation. Farthermore, they have not that tendency to induce sleep which we observe after the use of opium. The speedy operation, short period of influence, and, usually, the presence of convulsions distinguish the operation of hydrocyanic acid. Indian hemp induces a cataleptic state.¹² Vinous liquids cause their well-known peculiar inebriation. Their effects in small doses agree to a certain extent with those of small doses of opium; but they are not equally available as antispasmodics. The peculiarities of the operation of conia have been pointed out.

USES.—Opium is undoubtedly the most important and valuable remedy of the whole *Materia Medica*. For other medicines we have one or more substitutes; but for opium none, at least in the large majority of cases in which its peculiar and beneficial influence is required. Its good effects are not, as is the case with some valuable medicines, remote and contingent, but they are immediate, direct, and obvious; and its operation is not attended with pain or discomfort. Farthermore, it is applied, and with the greatest success, to the relief of maladies of every day's occurrence, some of which are attended with the most acute human suffering. These circumstances, with others not necessary here to enumerate, conspire to give to opium an interest not possessed by any other article of the *Materia Medica*.

We employ it to fulfil various indications; some of which have been already noticed. Thus we exhibit it, under certain regulations, to mitigate pain, to allay spasm, to promote sleep, to relieve nervous restlessness, to produce perspiration, and to check profuse mucous discharges from the bronchial-tubes and gastro-intestinal canal. But experience has proved its value in relieving some diseases in which not one of these indications can be at all times distinctly traced.

1. *In Fevers.*—The consideration of the use of opium in fever presents peculiar difficulties. Though certain symptoms which occur in the course of this disease, are, under some circumstances, most advantageously treated by opium, yet, with

¹ See an account of these opinions by Tralles, *Usus Opii*, Sect. 1. 1757.

² *Mat. Med.* ii. 225.

³ *Elementa Medicinæ.*

⁴ *Syst. of Mat. Med. and Therap.* Ed'nb.

⁵ See some remarks on the *modus operandi* of opium, by Mr. Ward, in the *Lond. Med. and Phys. Journ.*

vols. vii. viii. and ix.

⁶ *Treat. on the Venom of the Viper*, iii. 199.

⁷ Quoted by Orfila, *Toxicol. Gén.*

⁸ See Dr. O'Shaughnessy, *On the Prep. of the Indian Hemp*. Calc. 1839.

⁹ *Traité Élém. de Mat. M'd.* ii. 2nde éd.

¹⁰ *Op. supra cit.*

¹¹ *Elem. of Mat. and Therap.*

¹² *Ibid.*

one or more of these symptoms present, opium may, notwithstanding, be a very inappropriate remedy. The propriety or impropriety of its use, in such cases, must be determined by other circumstances, which, however, are exceedingly difficult to define and characterize. It should always be employed with great caution, giving it in small doses, and carefully watching its effects. The symptoms for which it has been resorted to are, *watchfulness, great restlessness, delirium, tremor, and diarrhoea*. When watchfulness and great restlessness are disproportionate, from first to last, to the disorder of the vascular system, or of the constitution at large; or when these symptoms continue after excitement of the vascular system has been subdued by appropriate depletives, opium frequently proves a highly valuable remedy; nay, the safety of the patient often arises from its judicious employment.¹ The same remarks also apply to the employment of opium for the relief of delirium; but it may be added that, in patients who have been addicted to the use of spirituous liquors, the efficacy of opium in allaying delirium is greatest. Yet I have seen opium fail to relieve the delirium of fever, even when given apparently under favourable circumstances; and I have known opium restore the consciousness of a delirious patient, and yet the case has terminated fatally. If the skin be damp, and the tongue moist, it rarely, I think, proves injurious. The absence, however, of these favourable conditions by no means precludes the employment of opium; but its efficacy is more doubtful. Dr. Holland² suggests that the condition of the pupil may serve as a guide in some doubtful cases; where it is contracted, opium being contraindicated. A similar suggestion with respect to the use of belladonna was made by Dr. Graves, to which I have offered some objections. When sopor or coma supervenes in fever, the use of opium generally proves injurious. Recently, the combination of opium and emetic tartar has been strongly recommended in fever with much cerebral disturbance, by Dr. Law³ and Dr. Graves.⁴

2. *In Inflammatory Diseases*.—Opium has long been regarded as an objectionable remedy in inflammation; but it is one we frequently resort to, either for the purpose of palliating particular symptoms, or even as a powerful auxiliary antiphlogistic remedy. The statement of Dr. Young,⁵ “that opium was improper in all those diseases in which bleeding was necessary,” is, therefore, by no means correct in a very considerable number of instances. The objects for which opium is usually exhibited in inflammatory diseases are to mitigate excessive pain, to allay spasm, to relieve great restlessness, to check excessive secretion, and to act as an antiphlogistic. In employing it as an anodyne, we are to bear in mind that it is applicable to those cases only in which the pain is disproportionate to the local vascular excitement; and even then it must be employed with considerable caution; for to “stupefy the sensibility to pain, or to suspend any particular disorder of function, unless we can simultaneously lessen or remove the causes which create it, is often but to interpose a veil between our judgment and the impending danger.”⁶ As an antiphlogistic, it is best given in conjunction with calomel, as recommended by Dr. R. Hamilton, of Lynn.⁷ The practice, however, does not prove equally successful in all forms of inflammation. It is best adapted for the disease when it affects membranous parts;⁸ and is much less beneficial in inflammation of the parenchymatous structure of organs. In *gastritis* and *enteritis* the use of opium has been strongly recommended by the late Dr. Armstrong.⁹ After bleeding the patient to syncope, a full opiate (as 80 or 100 drops of the tincture, or three grains of soft opium) is to be administered; and if the stomach reject it, we may give it by injection. It acts on the skin, induces quiet and refreshing sleep, and prevents what is called the hemorrhagic reaction. If the urgent symptoms return when the patient awakes, the same mode of treatment is to be followed, but combining calomel

¹ See some interesting observations on this subject, by Dr. P. M. Latham, *Lond. Med. Gaz.* vol. x. pp. 11, 12.

² *Med. Notes and Reflect.* p. 427, 2d ed. 1840.

³ *Ibid.* xx. 538.

⁴ Holland, *op. supra cit.* p. 424.

⁵ See Bruchet, *De l'Emploi de l'Opium dans les Phlegm. des Membr. muq. ser. et fibr.* 1828.

⁶ *Transactions of the Association of Apothecaries*, 1823.

⁷ *Lond. Med. Gaz.* xviii. 538, 694.

⁸ *Treatise on Opium*, p. 169, *Lond.* 1755.

⁹ *Ed. Med. Comment.* ix. 191.

with the opium. A third venesection is seldom required. In *peritonitis*, the same plan of treatment is to be adopted; but warm, moist applications are on no account to be omitted. Of the great value of opiates in *puerperal fever*, abundant evidence has been adduced by Dr. Ferguson.¹ In *cystitis*, opium, preceded and accompanied by bloodletting and the warm bath, is a valuable remedy; it relieves the scalding pain, by diminishing the sensibility of this viscus to the presence of the urine, and also counteracts the spasmodic contractions. In *inflammation of the walls of the pelvis of the kidney, and also of the ureters*, especially when brought on by the presence of a calculus, opium is a most valuable remedy; it diminishes the sensibility of these parts, and prevents spasm; farthermore, it relaxes the ureters, and thereby facilitates the passage of the calculus. In *inflammation of the gall-ducts*, produced by calculus, opium is likewise serviceable; but, as in the last-mentioned case, bloodletting and the warm bath should be employed simultaneously with it. In *inflammation of the mucous membranes*, attended with increased secretion, opium is a most valuable remedy. Thus, in *pulmonary catarrh*, when the first stage of the disease has passed by, and the mucous secretion is fully established, opium is frequently very beneficial; it diminishes the sensibility of the bronchial membrane to cold air, and thereby prevents cough. In severe forms of the disease, bloodletting ought to be premised. Given at the commencement of the disease, Dr. Holland² says that twenty or thirty drops of laudanum will often arrest it altogether. In *diarrhœa*, opium, in mild cases, is often sufficient of itself to cure the disease; it diminishes the increased muscular contractions and increased sensibility (thereby relieving pain), and at the same time checks excessive secretion. Aromatics and chalk are advantageously combined with it. In violent cases, bloodletting should precede or accompany it. *Mild or English cholera*, the disease which has been so long known in this country, and which consists in irritation or inflammation of the mucous lining of the stomach, is generally most successfully treated by the use of opium; two or three doses will, in slight cases, be sufficient to effect a cure. When opium fails, the hydrocyanic acid is occasionally most effective. In *dysentery*, opium has been found very serviceable; it is best given in combination with either ipecacuanha or calomel. I have already stated that, in *inflammation of the parenchymatous tissues of organs*, the use of opium is less frequently beneficial, but often injurious. Thus, in *inflammation of the cerebral substance*, it is highly objectionable, since it increases the determination of blood to the head, and disposes to coma. In *peripneumonia*, it is for the most part injurious; partly by its increasing the febrile symptoms, partly by its diminishing the bronchial secretion, and probably, also, by retarding the arterialization of the blood, and thereby increasing the general disorder of system. It must be admitted, however, that there are circumstances under which its use, in this disease, is justifiable. Thus, in acute peripneumonia, when bloodletting has been carried as far as the safety of the patient will admit, but without the subsidence of the disease, I have seen the repeated use of opium and calomel of essential service. Again, in the advanced stages of pneumonic inflammation, when the difficulty of breathing has abated, opium is sometimes beneficially employed to allay painful cough, and produce sleep. In *inflammation of the substance of the liver*, opium is seldom beneficial; it checks the excretion, if not the secretion, of bile, and increases costiveness. In *rheumatism*, opium frequently evinces its happiest effects. In acute forms of the disease it is given in combination with calomel, as recommended by Dr. R. Hamilton—bloodletting being usually premised. From half a grain to two grains of opium should be given at a dose. Dr. Hope³ recommends gr. vij or gr. x of calomel to be combined with each dose of opium. It is not necessary, or even proper, in ordinary cases, to affect the mouth by the calomel; though to this statement exceptions exist. The use of mercury may even, in some cases, be objectionable; and in such, Dover's powder will be found the best form of exhibition. This

¹ *Essays on the most Important Diseases of Women*, Part i. 1839.

² *Lond. Med. Gaz.* xix. 515.

³ *Op. supra cit.* p. 421.

plan of treatment is well adapted for the diffuse or fibrous form of acute rheumatism; but it does not prove equally successful in the synovial forms of the disease. It is also valuable in chronic rheumatism.

3. *In Diseases of the Brain and Spinal Cord.*—In some cerebro-spinal diseases great benefit arises from the use of opium; while in other cases injury only can result from its employment. The latter effect is to be expected in inflammation of the brain, and in apoplectic cases. In other words, in those cerebral maladies obviously connected with, or dependent on, an excited condition of the vascular system of the brain, opium acts injuriously. But there are many disordered conditions of the cerebro-spinal functions, the intensity of which bears no proportion to that of the derangement of the vascular system of the brain; and there are other deviations from the healthy functions in which no change in the cerebral circulation can be detected. In these cases, opium or morphia frequently evinces its best effects. In *insanity*, its value has been properly insisted on by Dr. Seymour.¹ He, as well as Messrs. Beverley and Phillips, employed the acetate of morphia. Its good effects were manifested rather in the low, desponding, or melancholic forms of the disease, than in the excited conditions; though I have seen great relief obtained in the latter form of the disease by full doses. Opium is sometimes employed by drunkards to relieve *intoxication*. I knew a medical man addicted to drinking, and who, for many years, was accustomed to take a large dose of laudanum whenever he was intoxicated and was called to see a patient. On one occasion, being more than ordinarily inebriated, he swallowed an excessive dose of laudanum, and died in a few hours of apoplexy.

In *delirium tremens*, the efficacy of opium is almost universally admitted. Its effects, however, require to be carefully watched; for large doses of it, frequently repeated, sometimes hasten coma and other bad symptoms. If there be much fever, or evident marks of determination of blood to the head, it should be used with great caution, and ought to be preceded by loss of blood, cold applications to the head, and other antiphlogistic measures. Though opium is to be looked on as a chief remedy in this disease, yet it is not to be regarded as a specific. Dr. Law² speaks in high terms of its association with emetic tartar. I have before noticed the use of opium in alleviating some of the *cerebral symptoms which occur during fever*.

In *spasmodic and convulsive diseases* opium is a most important remedy. In *local spasms produced by topical irritants*, it is a most valuable agent, as I have already stated; for example, in *spasm of the gall-duets or of the ureters*, brought on by the presence of calculi; in *colic*, and in *painful spasmodic contractions of the bladder, or rectum, or uterus*. In *spasmodic stricture* opium is sometimes useful. In *genuine spasmodic asthma*, which probably depends on a spasmodic condition of the muscular fibres investing the bronchial tubes, a full dose of opium generally gives temporary relief; but the recurrence of the paroxysms is seldom influenced by opium. There are several reasons for believing that one effect of narcotics in dyspnoea is to diminish the necessity for respiration. Laennec³ states that when given to relieve the extreme dyspnoea of mucous catarrh, it frequently produces a speedy but temporary cessation of the disease; and if we explore the respiration by the stethoscope, we find it the same as during the paroxysm—a proof that the benefit obtained consists simply in a diminution of the necessity for respiration. That the necessities of the system for atmospheric air vary at different periods, and from different circumstances, is sufficiently established by the experiments of Dr. Prout;⁴ and it appears that they are diminished during sleep, at which time, according to Dr. Edwards,⁵ the transpiration is increased. Moreover, the phenomena of hibernating animals also bear on this point; for during their state of torpidity, or hibernation, their respiration is proportionally diminished.

¹ *Lond. Med. Gaz.* vol. ix. p. 114; and *Med.-Chir. Trans.* vol. xix. p. 167.

² *Lond. Med. Gaz.* xviii. 538 and 691.

³ *Treat. on the Diseases of the Chest*, by Forbes, pp. 77 and 99, 1827.

⁴ *Ann. of Phil.* ii. 330; and iv. 331.

⁵ *De l'Infl. des Agens Physiq.* p. 321, 1824.

In the *convulsive diseases* (*chorea*, *epilepsy*, and *tetanus*) opium has been used, but with variable success; in fact, the conditions of system under which these affections occur, may be, at different times, of an opposite nature; so that a remedy which is proper in one case is often improper in another. In *tetanus*, opium was at one time a favourite remedy, and is undoubtedly at times a remedy of considerable value. But it is remarkable that the susceptibility of the system to its influence is greatly diminished during *tetanus*. I have already referred to the enormous quantities which may, at this time, be taken with impunity. In 128 cases noticed by Mr. Curling,¹ opium in various forms, and in conjunction with other remedies, was employed in 84 cases; and of these, 45 recovered. Notwithstanding, however, the confidence of the profession in its efficacy is greatly diminished.

Lastly, opium occasionally proves serviceable in several forms of *headache*, especially after loss of blood. I have seen it give great relief in some cases of what are commonly termed nervous headaches; while in others, with apparently the same indications, it has proved injurious. Chomel² applied, with good effect, opium cerate to a blistered surface of the scalp, to relieve headache.

4. *In Diseases of the Chest*.—In some affections of the heart and of the organs of respiration opium is beneficial. I have already alluded to its employment in *catarrh*, *peripneumonia*, and *spasmodic asthma*. In the first of these maladies caution is often requisite in its use. "In an aged person, for example, suffering under *chronic bronchitis* or *catarrhal influenza*—and gasping, it may be, under the difficulties of cough and expectoration—an opiate, by suspending these very struggles, may become the cause of danger and death. The effort here is needed for the recovery of free respiration; and if suppressed too long, mucus accumulates in the bronchial cells, its extrication thence becomes impossible, and breathing ceases altogether."³

5. *In Maladies of the Digestive Organs*.—I have already referred to the use of opium in *gastritis*, *enteritis*, *peritonitis*, *diarrhœa*, *dysentery*, *colic*, the *passage of gall-stones*, and in *hepatitis*. With respect to the use of opium in *hepatic affections*, I am disposed to think, with Dr. Holland, that, with the exception of the painful passage of a gall-stone through the ducts, there is scarcely a complaint of the liver and its appendages "where opium may not be said to be hurtful, though occasionally and indirectly useful when combined with other means."⁴ In *poisoning by acrid substances* opium is used with advantage to lessen the susceptibility of the alimentary canal, and thereby to diminish the violence of the operation of these local irritants. Cantharides, all the drastic purgatives, when taken in excessive doses (as *elaterium*, *colocynth*, *gamboge*, *scammony*, and *croton oil* or seeds), and *Arum maculatum*, may be mentioned as examples of the substances alluded to. Besides the above-mentioned beneficial operation, opium allays the spasmodic contractions of the bowels, relieves pain, and checks inordinate secretion and exhalation.

In *poisoning by corrosives* (the strong mineral acids and alkalies, for example), opium diminishes the sensibility of the alimentary canal; it cannot, of course, alter the chemical influence of the poisons, but it may prove useful by allaying the consequences of inflammation.

As *meconic acid* is said to be an antidote in cases of poisoning by corrosive sublimate, opium, in full doses, may perhaps be administered with some advantage, when other antidotes cannot be procured.

In poisoning by the preparations of arsenic, of lead, and of copper, opium is sometimes found useful.

6. *In maladies of the urino-genital apparatus* opium is a most valuable remedy. It mitigates pain, allays spasmodic action, checks copious mucous secretion, and diminishes irritation. Its use for one or more of these purposes in *nephritis*, *cystitis*, the *passage of urinary calculi*, and *spasmodic stricture*, has been already pointed out. In *irritable bladder* it is an invaluable remedy, especially in conjunction with

¹ *Treat. on Tetanus*, p. 151, 1836.

² Holland, *op. supra cit.* p. 425.

³ *Lond. Med. Gaz.* vol. i. p. 156.

⁴ *Op. supra cit.* p. 429.

liquor potassæ. In irritation and various painful affections of the uterus, and in *chordee*, the value of opium is well known. In the treatment of the *phosphatic diathesis* it is the only remedy that can be employed, according to Dr. Prout, to diminish the unnatural irritability of the system.

Of all remedies for that hitherto intractable malady, *diabetes*, opium has been found to give the most relief.¹ Under its use the specific gravity, saccharine quality, and quantity of urine have been diminished. It has not, however, hitherto succeeded in permanently curing this disease. Dr. Prout has also found it serviceable when there is an *excess of urea in the urine*.²

7. *As an Anodyne*.—To relieve pain by dulling the sensibility of the body, opium is, of all substances, the most useful, and the most to be relied on for internal exhibition. We sometimes use it to alleviate the pain of inflammation, as already mentioned; to diminish spasm and the sensibility of the part in calculi of the gall-ducts, in the ureters, and even when in the urinary bladder; to relieve pain in the various forms of scirrhus and carcinoma, in which diseases opium is our sheet-anchor; to allay the pain arising from the presence of foreign bodies in wounds; to prevent or relieve after-pains; to diminish the pain of menstruation; and, lastly, as an anodyne in neuralgia. As a *benumber* or *topical anodyne* it is greatly inferior to aconite. Hence, in neuralgia, the latter is much more successful than opium. (See *Aconitum*.)

8. *In Hemorrhages*.—Opium is at times serviceable to obviate certain *ill effects of hemorrhages*; as when there is great irritability attended with a small and frequent pulse, and also to relieve that painful throbbing about the head so often observed after large evacuations of blood. In or immediately after *uterine hemorrhage* the use of opium has been objected to, on the ground that it might prevent the contraction of the womb; but where the employment of opium is otherwise indicated, this theoretical objection deserves no weight. In *bronchial hemorrhage* it is at times a valuable remedy, and may be associated with acetate of lead (notwithstanding the chemical objections to the mixture) with good effect.

9. *In Mortification*.—When mortification is attended with excessive pain, opium is resorted to. In that kind of mortification called *gangræna senilis*, which commences without any visible cause, by a small purple spot on the toes, heels, or other parts of the extremities, and which sometimes arises from an ossified condition of the arteries, Mr. Pott³ strongly recommended opium, in conjunction with a stimulating plan of treatment, and experience has fully proved its great efficacy.

10. *In Venereal Diseases*.—Opium is frequently employed in venereal diseases to prevent the action of mercurials on the bowels during salivation; also to allay the pain of certain venereal sores, and venereal diseases of the bones. By some it has, in addition, been employed as an anti-venereal remedy; and, according to Michaelis⁴ and others, with success. Moreover, it is stated by Dr. Ananian, who practised at Constantinople, that those persons who were in the habit of taking opium rarely contracted the venereal disease. But opium possesses no specific anti-venereal powers.⁵ It has appeared to me, on several occasions, to promote the healing of venereal sores.

11. In various forms of *ulcers*, and in *granulating wounds*, the efficacy of opium has been satisfactorily established by Mr. Skey.⁶ Richter⁷ and others⁸ had already noticed its good effects; but their statements had attracted little attention. Mr. Grant,⁹ in 1785, pointed out the efficacy of opium in the treatment of foul ulcers, attended with a bad discharge, and much pain. He ascribed these symptoms to "morbid irritability," which the opium removed. Its use is prejudicial in ulcers

¹ See Prout, *Inq. into the Treat. of Diabetes*, &c. p. 74, 2d ed. 1825.

² *Inq. into the Treat. of Diabetes*, &c. p. 54, 2d ed. 1825.

³ *Chir. Obs.* 1775.

⁴ Pearson, *Observ. on the Effects of Various Art. of the Mat. Med. in Lues Ven.* p. 57, 1800.

⁵ *On a new Method of Treatment employed in the Cure of various forms of Ulcer and Granulating Wounds*, Lond. 1837.

⁶ *Comm. Soc. Scient. Gött.* vol. xv.

⁷ *Lond. Med. Journ.* vi. 5, and 130.

⁸ *Med. Communications*, vol. i.

⁹ See Ploucquet's *Lit. Med.* iv. 214, 1809.

attended with inflammation, in the florid or sanguineous temperament, and in childhood. But in the chronic or callous ulcer, in the so-called varicose ulcer, in recent ulcers (from wounds), in which granulation proceeds slowly, or in other cases, the efficacy of opium, administered in small doses (as ten drops of laudanum three times daily), is most manifest, especially in elderly persons, and in those whose constitutions have been debilitated by disease, labour, spirituous liquors, &c. It appears to promote the most genial warmth, to give energy to the extreme arteries, and thereby to maintain an equal balance of the circulation throughout every part of the body, and to animate the dormant energies of healthy action.

12. The *external application* of opium is comparatively but little resorted to, and for two reasons: in the first place, its topical effects are slight; and secondly, its specific effects on the brain and general system are not readily produced through the skin. Aconite and belladonna greatly exceed opium in their topical effects. The following are some of the local uses of opium: In *ophthalmia*, the wine of opium is dropped into the eye when there is excessive pain (see *Vinum Opii*). In *painful and foul sores*, opiates are used with occasional good effects. Mr. Grant¹ applied the tincture twice a day, in an oatmeal poultice, to irritable sores. Opiate *frictions* have been employed as topical anodynes, and to affect the general system. Thus, in *chronic rheumatism and sprains*, the opium liniment proves a useful application. In *maniacal delirium*, as well as some other cerebral disorders, Mr. Ward² employed, with apparently beneficial effects, opiate frictions; for example, ℥ss of opium, mixed with gr. iv of camphor, ℥iv of lard, and ℥j of olive oil. In *neuralgic affections*, an opiate cerate, or finely powdered hydrochlorate of morphia, applied to a blistered surface, occasionally gives relief. In *gastrodynia*, it may be applied in the same way to the epigastrium (Holland). In *gonorrhœa and gleet*, opium injections have been used. In *spasmodic stricture, diseases of the prostate gland*, and in *gonorrhœa to prevent chordee*, an opiate suppository is a useful form of employing opium, especially where it is apt to disagree with the stomach. In *nervous and spasmodic affections* (as some forms of asthma), the endermic application of opium or morphia, applied along the course of the spine, is often singularly beneficial, when all methods of depletion and counter-irritation have proved utterly unavailing (Holland). In *toothache*, opium is applied to the hollow of a carious tooth. Dr. Bow³ speaks in the highest terms of the efficacy of the external application of opium in *inflammatory diseases*, but especially *bronchitis and croup*.

ADMINISTRATION.—Opium is given, *in substance*, in the form of pill, powder, lozenge, or electuary. The dose is subject to great variation, depending on the age and habits of the patient, the nature of the disease, and the particular object for which we wish to employ it. In a general way, we consider from an eighth of a grain to half a grain a *small dose* for an adult. We give it to this extent in persons unaccustomed to its use, when we require its stimulant effects, and in mild catarrhs and diarrhœas. From half a grain to two grains we term a *medium dose*, and employ it in this quantity as an ordinary anodyne and soporific. From two to five grains we denominate a *full or large dose*, and give it to relieve excessive pain, violent spasm, in some inflammatory diseases after bloodletting, in tetanus, &c. These are by no means to be regarded as the limits of the use of opium. *Opium pills (pilulæ opii)* may be prepared either with crude or powdered opium. The latter has the advantage of a more speedy operation, in consequence of its more ready solution in the gastric liquor. Employed as a *suppository*, opium is used in larger doses than when given by the stomach. Five grains, made into a cylindrical mass with soap, may be introduced into the rectum, to allay irritation in the urino-genital organs.

ANTIDOTES.—In a case of poisoning by opium, the first indication is to remove the poison from the stomach, the second is to neutralize any of it which may be retained in the system, and the third is to obviate its injurious effects.

¹ *Op. supra cit.*

² *Lancet*, March 18, 1837.

³ *Med. and Phys. Journ.* vol. i. p. 440, 1799.

1. **Use of Evacuants.**—Until other and more powerful evacuant means can be obtained, we should have recourse to tickling the throat with the fingers, or with a feather dipped in oil. As domestic emetics, mustard or salt may be exhibited. A dessertspoonful of flour of mustard, or a tablespoonful of salt, may be taken, stirred up in a tumblerful of water. The stomach-pump is, however the best means of evacuating the contents of the stomach, and, when it can be procured, should always be preferred. The emetics usually resorted to are the sulphates of zinc and copper; the first is preferred. It should be given in doses of from one to two scruples. The dose of sulphate of copper is less—from five grains to fifteen. Ipecacuanha or tartar emetic may be resorted to when the other means are not at hand. Clysters containing fifteen or twenty grains of tartar emetic may be administered; or, in extreme cases, a solution of one or two grains of this salt may be injected into the veins, taking care to prevent the introduction of air.

2. **Use of Chemical Antidotes.**—There are no known agents which completely destroy the activity of opium by their chemical properties, and which can be resorted to in these cases. Infusion of galls, however, is regarded as the best, though an imperfect antidote. Magnesia, as well as iodine and chlorine, have also been recommended.

3. **Use of Therapeutical Means to obviate the Effects.**—The following are the principal means which have been found efficacious:—

a. *Rousing the patient*, by exercising him up and down a room between two men. It may sometimes be necessary to continue this for several hours.—β. *Cold affusion*. Cold water dashed over the head and chest is an exceedingly valuable agent. It often assists the operation of emetics. Dr. Boisragon¹ recommends the alternation of impression, with hot or cold water, and at different parts of the surface of the body.—γ. *Irritants*. The application of irritants to the body is also sometimes a useful practice; thus blisters and sinapisms to the feet.—δ. *Venesection*. Bloodletting is sometimes necessary; but it can be safely practised only after the opium has been withdrawn from the stomach. Orfila says that under these circumstances it never increases but in most cases materially relieves the symptoms.—ε. *Stimulants*. Ammonia, camphor, musk, coffee, and other stimulants, are sometimes used with advantage.—ζ. *Vegetable acids*. Orfila has found the vegetable acids to be the best anti-narcotics. For this purpose, drinks of vinegar and water, lemon-juice, or cream of tartar and water, should be given every ten minutes. These agents, however, should not be resorted to till the poison has been evacuated from the stomach.—η. *Artificial respiration*. As a last resource this is on no account to be omitted. Death has on several occasions been apparently averted by it. An interesting case, in which it was successfully practised, was published many years ago by Mr. Whately.² Natural respiration was extinct when it was begun. In another successful case, related by Mr. Smith,³ artificial respiration was kept up for four hours and a half (with an interval of an hour). When it was commenced there was no pulse at the wrist, and only a slight irregular action of the heart, indicative that life was not quite extinct. A third case, also successful, is that of an infant ten days old, which had taken twenty-five or thirty drops of laudanum intended for the mother, and had lost the power of deglutition, was comatose, and had several convulsions. Artificial respiration was sustained for two or three hours.⁴—[θ. *Electricity* and electro-magnetism have also been successfully employed of late years in several cases of poisoning by opium. This agent has been found effectual in keeping roused, children that are labouring under the effects of narcotic poison.—ED.]

PREPARATIONS.—In noticing the preparations of the poppy employed in medicine, I shall arrange them under three heads: 1st, Preparations of poppy-heads; 2dly, Of opium; 3dly, Of morphia.

¹ *Lond. Med. Gaz.* March 6, 1840.

² *Med.-Chir. Trans.* xx. 66.

³ *Med. Obs. and Inq.* vi. 331.

⁴ *United States Dispensatory.*

a. Preparations of Poppy-Heads.

1. **DECOCTUM PAPAVERIS**, L. E. D.; *Decoction of Poppy; Poppy Fomentation*.—(Poppy-heads, sliced, ℥iv ; Water Oiv. [Oij, E. D.] Boil for a quarter of an hour [ten minutes, D.], and strain.)—The seeds contribute, by their oleaginous properties, to the emollient quality of the decoction. This preparation forms a common fomentation, which is applied to bruised, inflamed, excoriated, tender, or swollen parts; to the eye in ophthalmia, to the abdomen in enteritis, peritonitis, to tender ulcers, &c. In cancer and other painful affections of the uterus, it is thrown into the vagina as a soothing remedy.

2. **SYRUPUS PAPAVERIS**, L. E.; *Syrup of White Poppies*.—(Poppy-heads, without the seeds, lb. iij [lb. iss. E.]; Sugar [pure, E.] lb. v. [lb. iij, E.]; Boiling Water, Cong. v. [Oxv. E.]; [Rectified Spirit, ℥v , L.] Boil down the capsules in the water to two gallons, and strongly express the liquor. Again boil down the strained liquor to four pints, and filter while hot. Set it by for twelve hours that the dregs may subside; then boil down the clear liquid to two pints, add the sugar and dissolve it; lastly, mix in the spirit, L.—The *Edinburgh Pharmacopœia* directs the poppy-heads to be first macerated in water for twelve hours; then to boil down to five pints, and strain and express strongly through calico. Again to boil down to Oiiiss, add the sugar, and dissolve with the aid of heat.)—Syrup of poppies, especially if too thin, is very liable to ferment, and then contains spirit or acetic acid, or both, and is of course ill adapted for medicinal use. To check these changes, it should be carefully made with spirit, according to the directions of the London College, taking care that it has the proper consistence, and keeping it in a cool place. Occasionally, a mixture of treacle and laudanum, or of syrup and extract of poppies, has been substituted; but this fraud is highly dangerous, and has on several occasions proved fatal to children.¹ Syrup of poppies is narcotic, sedative, and anodyne, and is commonly employed as the infant's opiate. It mitigates pain, allays spasm and troublesome cough, and promotes sleep. Even in the adult it is sometimes used for these purposes. It forms a useful adjunct to pectoral tinctures. Over ordinary opiates it has the positive advantages of a less disagreeable taste, and the supposed one of being less likely to create nausea and headache. Even when properly prepared, its administration to infants requires the greatest caution, on account of their known susceptibility to the influence of opiates. "I have been informed," says Dr. Montgomery, "of more than one instance in which a teaspoonful has been known to prove fatal to a healthy child."—The dose of it, for an infant of three or four months old, is f℥ss ; for adults, from f℥ij to f℥iv .

3. **EXTRACTUM PAPAVERIS**, L. E.; *Extract of Poppy*.—(Poppy-heads, without the seeds, bruised, ℥xv ; Boiling [distilled, L.] Water, Cong. j. Macerate for twenty-four hours; then boil down to four pints, and filter the liquor while hot; lastly, evaporate to a proper consistence [by the vapour bath, E.])—Anodyne and soporific. It appears to me to produce effects similar to those of opium, for which it is frequently substituted, on the supposition that, while it allays pain and promotes sleep, it is less liable to occasion nausea, constipation, headache, or delirium. If it be prepared from a decoction, instead of an infusion of poppy-heads, as directed in the pharmacopœias, it will contain a considerable quantity of inert mucilaginous matter.—Dose, gr. ij to ℥j .

b. Preparations of Opium.

1. **PILULÆ OPII** *sive* **THEBAICÆ**, E; *Opium Pills*.—(Opium *one part*; Sulphate of Potash *three parts*; Conserve of Red Roses *one part*. Beat them into a proper mass, which is to be divided into five-grain pills.—It is to be observed that this pill contains twice as much opium as the opiate pill of the last Latin edition of this

¹ See the cases referred to by Dr. Montgomery, in his *Obs. on the Dublin Pharm.* 472.

pharmacopœia, *E.*)—Employed as an anodyne and soporific.—Dose, one or two pills (*i. e.* gr. v to gr. x). The sulphate of potash serves to divide the opium. One pill of five grains contains one grain of opium.

2. *PILULÆ SAPONIS COMPOSITÆ*, L. D. [U. S.]; *Compound Soap Pills*.—(Opium powdered; Liquorice, powdered, each $\mathfrak{z}\text{ij}$; Soft Soap $\mathfrak{z}\text{vj}$. Beat them together until incorporated, *L.*—Opium, in fine powder, $\mathfrak{z}\text{ss}$; Castile Soap $\mathfrak{z}\text{ij}$; Distilled Water $\mathfrak{z}\text{ss}$, or as much as is sufficient. Reduce the soap to a fine powder, add the opium and water, and beat the mixture into a mass of a uniform consistence, *D.* [U. S.])—Employed as an anodyne and soporific.—Dose, gr. ij to gr. x. Five grains contain one grain of opium. [Two and a half grains U. S. contain gr. i opium.] The soap enables the pills to dissolve readily in the juices of the stomach. From gr. v to \mathfrak{g} are sometimes used as a suppository.

3. *PILULÆ CALOMELANOS ET OPII*, *E.* (See Index.)

4. *PILULÆ PLUMBI OPIATÆ*, *E.* (See Index.)

5. *TROCHISCI OPII*, *E.*; *Opium Lozenges*.—(Opium $\mathfrak{z}\text{ij}$; Tincture of Tolu $\mathfrak{z}\text{ss}$; Pure Sugar, in fine powder, $\mathfrak{z}\text{vj}$; Powder of Gum-Arabic, and Extract of Liquorice, softened with boiling water, of each $\mathfrak{z}\text{v}$. Reduce the opium to a fluid extract by the formula [given for extract of opium]; mix it intimately with the liquorice previously reduced to the consistence of treacle; add the tincture; sprinkle the gum and sugar into the mixture, and beat it into a proper mass, which is to be divided into lozenges of ten grains.)—In London, the manufacture of lozenges is practised as a distinct trade. The opium lozenges of the shops usually contain each about one-eighth of a grain of opium. Lozenge-makers employ a much smaller proportion of gum. The tincture of tolu, which they use, is much more concentrated than that of the shops, the spirit of which is objectionable. Opium lozenges are used to allay troublesome cough.

6. *PULVIS CRETÆ COMPOSITUS CUM OPIO*, L.; *Pulvis Cretæ Opiatus*, *E. D.*; *Compound Powder of Chalk with Opium*.—(Compound Powder of Chalk $\mathfrak{z}\text{viss}$ [$\mathfrak{z}\text{vj}$, *E.*; $\mathfrak{z}\text{iv}$, $\mathfrak{z}\text{vij}$, *D.*]; Powder of Opium $\mathfrak{g}\text{iv}$ [$\mathfrak{z}\text{j}$, *D.*]. Triturate them together thoroughly [and pass through a fine sieve, *D.*])—Astringent and narcotic. Employed in diarrhœa.—Dose for adults, \mathfrak{g} to $\mathfrak{g}\text{ij}$; for children, grs. ij to grs. x, according to their age. Forty grains of this powder, prepared according to the London or Dublin Pharmacopœia, or thirty-seven of the Edinburgh Pharmacopœia, contain one grain of opium.

7. *CONFECTIO OPII*, L. [U. S.]; *Electuarium Opii*, *E.*; *Confection of Opium*; *Philonium Londinense*; *Philonium Romanum*.—(Opium, powdered, $\mathfrak{z}\text{vj}$; Long Pepper $\mathfrak{z}\text{j}$; Ginger $\mathfrak{z}\text{ij}$; Caraway $\mathfrak{z}\text{iiij}$; Tragacanth, powdered, $\mathfrak{z}\text{ij}$; Syrup $\text{f}\mathfrak{z}\text{xvj}$. The London College directs the dry ingredients to be kept mixed in the form of a very fine powder, and the syrup to be added when the confection is to be used. The Edinburgh College adopts the following formula: "Aromatic Powder $\mathfrak{z}\text{vj}$; Senega, in fine powder, $\mathfrak{z}\text{iiij}$; Opium, diffused in a little Sherry, $\mathfrak{z}\text{ss}$; Syrup of Ginger lbj . Mix them together, and beat into an electuary.")—Aromatic and narcotic. Employed in flatulent colic and diarrhœa; in the latter complaint usually as an adjunct to the

¹ The ancient philonium was a famous electuary of the opiate kind. It was called Philo's antidote, after Philo, of Tarsus, its inventor, who lived, it is supposed, in Augustus's time. The composition of the Philonium, described in Greek elegiac verses, is preserved and explained by Galen, *De med. comp. sec. loc.* lib. ix. 4. The terms of the receipt are enigmatical, and may amuse some readers: we give the substance: "Take of the yellow and fragrant hair of the divine Crocus, whose blood glitters in the fields of Mercury; as many drachms as a man has senses; of the Eubœan Nauplian, a drachm; of the slayer of Menœtiades, as preserved in the bowels of sheep, the like quantity; add twenty drachms of white flame, and twenty of the bean of the wild animal of Arcadia; a drachm of the root (falsely so called) which grows in the land famous for the Pisean Jove; take twice five drachms of $\pi\acute{\iota}\nu\eta$, written with the masculine article prefixed; and mingle all with the production of the daughters of the bulls of Athens." Galen interprets this curious medico-poetical farrago, which, without his aid, would certainly be not a little obscure, as implying the admixture of saffron, pyrethrum, euphorbium, white pepper, hyoscyamus, spikenard, opium, and Athenian honey. It is, moreover, stated in the verses, that the pains for which this $\alpha\acute{\iota}\gamma\alpha\ \epsilon\upsilon\sigma\mu\alpha$ was most serviceable, were those of colic, of the liver, dysuria, and stone.—(Dr. Wm. Cunnin, *Lond. Med. Gaz.* vol. xvii. p. 990.)

chalk mixture.—Dose, gr. x to ʒj.—The *Dublin* preparation of the older pharmacopœias contained gr. j of opium in about twenty-five grains of confection. The *London* preparation is somewhat weaker, and contains gr. j of opium in perhaps thirty-six grains. The *Edinburgh* preparation is still weaker; forty-three grains of it containing about one grain of opium.—[The *U. S. Pharm.* directs Opium in powder four drachms and a half; Aromatic Powder six ounces; Clarified Honey fourteen ounces. Rub the opium with the aromatic powder; then add the honey, and beat them together until thoroughly mixed. About thirty-six grains contain one of opium.]

8. EMPLASTRUM OPII, L. E. D.; *Plaster of Opium*.—(Extract of Opium ʒj; Prepared Resin of the Spruce Fir ʒij; Plaster of Lead ʒviiij; Boiling Water f ʒj. Add the resin of the spruce fir, the opium, and the water, to the melted plaster, and with a slow fire boil down until all unite into a proper consistence, *L.*—The *Edinburgh College* omits the water. The formula of the *Dublin College* is as follows: Of Opium, in very fine powder, ʒj; Resin Plaster ʒix. Melt the plaster by steam or water bath, add the opium by degrees, and mix thoroughly. [The *U. S. Pharm.* directs Opium in powder two ounces; Burgundy Pitch three ounces; Lead Plaster a pound; Boiling Water four fluidounces. The process is similar to the above.]—Employed as a tonic anodyne in rheumatism, lumbago, and neuralgia. Its powers are very slight, or even equivocal.

9. EXTRACTUM OPII, L. [U. S.]; *Extractum Opii*, E.; *Extractum Opii aquosum*, D.; *Extract of Opium*.—(Opium, sliced, ℞iiss [℞j, *E. D. U. S.*]; Water [distilled, Ovj, *L.*], [Ovj, *D.*], [Ovj, *U. S.*] Add O℞iiss of the water to the opium, and macerate for twenty-four hours, stirring occasionally with a spatula, then strain. Macerate what is left in the remaining water for twenty-four hours, and strain. Lastly, evaporate to a proper consistence, *L.*—The *Edinburgh College* digests five times successively; each time in a pint of water, and for twenty-four hours each time. Filter the successive infusions as they are made, passing them through the same filter; unite and evaporate them in the vapour-bath to the due consistence. [The *U. S. P.* follows the *Edinburgh*.]—The *Dublin College* digests the water in like manner, but in successive quarts.)—When opium is digested in water, this fluid takes up the *odorous principle*, the *salts of morphia* and *codeia*, the *narcotina*, the *gum*, the *extractive*, and some of the *resin*. A portion of morphia is frequently found in the dregs. Moreover, a portion of the *oil* is found in the solution. By concentration, the odorous principle is dissipated, and the resin and the oil, combined with and in part saturating the narcotina, are separated. These matters would be more completely got rid of by redissolving the extract in water. The removal of these inert principles, as well as the impurities of opium and the consequent concentration of the active constituents of this substance, must, of course, render the extract a more powerful preparation than ordinary opium. Good opium yields more than half its weight (from 60 to 70 per cent.) of extract, which, therefore, should be at least one-third more active than crude opium. It is usually believed to operate with less disturbance to the general system than the ordinary preparations of opium. It is employed as an anodyne, sedative, and soporific, in cases where crude opium or its tincture disagrees.—The dose of it is from gr. ¼ to gr. iij or gr. iv.

LIQUOR OPII SEDATIVUS.—Mr. Battley, some years since, assured me that the only ingredients employed in the preparations of his *liquor opii sedativus* were opium, water, and heat. It appears to contain somewhat less meconic acid than the ordinary tincture of opium. Probably this and some other principles of opium are got rid of by successive evaporations and solutions. Perhaps an aqueous solution of the watery extract of opium, with the addition of a little spirit to preserve it, would be a convenient substitute.

10. TINCTURA OPII, L. E. D. [U. S.]; *Tincture of Opium*; *Laudanum*.—(Opium, powdered, ʒiij; Proof Spirit Oij; [Diluted Alcohol, *U. S.*] Macerate for seven [fourteen, *U. S.*] days, and filter, *L.* [*U. S.*])—The proportions used by the *Dublin*

College are also ℥ij of Opium, and Oij of Proof Spirit. The *Edinburgh College* directs—"Opium, sliced, ℥ij; Rectified Spirit Oj and fʒvij; Water fʒxiiiss. Digest the opium in the water at a temperature near 212° for two hours; break down the opium with the hand; strain and express the infusion; macerate the residuum in the rectified spirit for about twenty hours, and then strain and express very strongly. Mix the watery and spirituous infusions, and filter.—This tincture is not easily obtained by the process of percolation; but when the opium is of fine quality, it may be prepared thus: Slice the opium finely; mix the spirit and water; let the opium macerate in fourteen fluidounces of the mixture for twelve hours, and then break it down thoroughly with the hand; pour the whole pulpy mass and fluid into a percolator, and let the fluid part pass through, and the rest of the spirit without packing the opium in the cylinder, and continue the process of percolation till two pints are obtained," *E*.)—The percolation process of the *Edinburgh College* is unnecessary and troublesome, and will, I suspect, be rarely, if ever, adopted by laudanum preparers. Tincture of opium is of a deep brownish-red colour, with the peculiar odour and taste of opium. Its sp. gr., according to Mr. Phillips,¹ is 0.952. Nineteen minims of it contain about one grain of opium. Proof spirit dissolves the same constituents as water, but it takes up a large proportion of narcotina, resin, and oil. I have repeatedly prepared morphia from the insoluble residue left behind in the preparation of the tincture.

[Some difference of opinion exists respecting the real strength of the Tincture of Opium of the *Pharmacopœias*. In the translation of the last edition of the *London Pharmacopœia*,² Mr. Phillips states that *nineteen minims* contain, or are equivalent to, one grain of solid opium, and he describes the ordinary dose as from ten to sixty minims. Mr. Squire, in his translation of the three *Pharmacopœias*, states that the tincture of opium is of the same strength in all, and that "one grain of powdered opium is employed to produce *thirteen minims* of the tincture." Dr. Christison says: "The *Tinctura Opii*, commonly called *laudanum*, is made by all the Colleges with such proportions of the opium and spirit, that about *thirteen minims and a half*, or about twenty-five drops, contain the active part of one grain of opium. But the *London tincture* may be sometimes sixteen per cent. stronger than the others, as dry opium is directed to be used. The tincture of the shops is very often adulterated. Good tincture should leave, when thoroughly dried up in the vapour-bath, from seventeen to twenty-two grains of residuum for every fluidounce; but I have several times found it so low as ten or seven only." The dose, according to Dr. Christison, is from fifteen to forty-five minims.

This question has been recently examined by Dr. Garrod, with results differing from those stated in the text. Dr. Garrod did not find that the undissolved portion, after maceration for the tincture, yielded any morphia. It yielded an abundance of narcotine and meconic acid. The residue, given internally, in doses varying from one to thirty grains, was found to be quite inert. Should traces of morphia be left after the ordinary process of preparing the tincture of the *London College*, Dr. Garrod does not believe that this would make any appreciable difference in the strength of the preparation. He considers "that the *Tinctura Opii* contains the active matter of the *whole* of the drug used in its formation; and therefore about *twelve minims* of tincture of opium possesses all the activity of *one grain* of crude opium, assuming that it loses only twelve per cent. in the drying. If dry opium is taken for comparison, *one grain* is contained in about *thirteen and a half minims*; and therefore one fluidrachm of *tinctura opii* contains five grains of the drug, or four and a half grains (according as it is compared with dry or moist opium), in place of three grains."

"In the *Edinburgh preparation*, the amount of tincture containing a grain of opium is about *thirteen and a half minims*; for the opium is ordered in the same proportion, but not previously reduced to powder or dried. In the *Dublin pre-*

¹ *Transl. of the Pharm.*

² *Pharm. Lond.* 1851.

paration the opium is ordered to be coarsely powdered, but Avoirdupois weight is used in place of Apothecaries', which makes the strength of the tincture such that *twelve minims and three-quarters* contain one grain of opium."¹

It follows from this statement, that when tincture of opium is properly made, and the directions of the London Pharmacopœia are strictly carried out, the strength of the tincture is much greater than it has been hitherto supposed to be. One fluidrachm will represent a dose of five grains, instead of three grains of opium, as stated by Mr. Phillips. The purity of the opium, its comparative strength in morphia, the strength of the spirit used as a solvent, and the period of maceration, will, however, materially affect the result. According to our observation, the statement of Dr. Christison, that the quantity of soluble matter taken up is subject to great variation, is correct; and unless it be assumed that the morphia is constantly in the same proportion in every sample of opium, and that the whole of the morphia is invariably taken up by the proof spirit, the tincture must necessarily vary in its strength. A practical solution of this question would be obtained by observing whether the effects of a grain of opium are really obtained by the administration of twelve or thirteen minims of an average tincture.—Ed.]

Tincture of opium is a powerful and valuable anodyne and soporific. Its employment is to be preferred to that of solid opium where a more immediate effect is required. Moreover, in administering opiates to children, the facility of adjusting small doses of it presents a great advantage over solid opium. The dose of it, like that of solid opium, must vary according to several circumstances. For an adult it varies from ℥x to fʒj. To children it must be given with the greatest caution. I have seen a powerful effect produced in an infant by one drop. In infants exhausted by illness and of a delicate constitution, one minim might cause death.

11. *TINCTURA OPII ACETATA*, U. S. *Acetated Tincture of Opium*.—(Take of Opium two ounces; Vinegar twelve fluidounces; Alcohol half a pint. Rub the opium with the vinegar; then add the alcohol, and, having macerated for fourteen days, express, and filter through paper.)—This preparation was introduced into the pharmacopœia as a substitute for *Black Drop*. The dose is ℥x.

12. *TINCTURA OPII CAMPHORATA*, U. S. *Camphorated Tincture of Opium*. *Paregoric Elixir*.—(The formula for this preparation of the British Colleges has been given at page 404, under the name of *Tinctura Camphoræ Composita*. That of the U. S. Pharm. is Opium, in powder, Benzoic Acid, each a drachm; Oil of Anise a fluidrachm; Clarified Honey two ounces; Camphor two scruples; Diluted Alcohol two pints. Macerate for fourteen days, and filter through paper. About two grains of opium are contained in the ounce. For its uses, see p. 405.)]

13. *ENEMA OPII*, L.; *Enema Opii vel Anodynum*, E.; *Opium Clyster*.—(Decoction of Starch fʒiv; Tincture of Opium ℥xxx. Mix, L.—The *Edinburgh College* uses ʒss of Starch; fʒss to fʒj of Tincture of Opium; and fʒij of Water. The starch is boiled in the water, and the tincture added when the mucilage is cool enough for use.)—The formula of the London College is, in my opinion, to be preferred to that of the Edinburgh College; but it may be sometimes necessary to double or treble the quantity of tincture employed. In the passage of renal calculi, in nephritis, irritation or inflammation of the bladder, uterus, or prostate gland, in dysentery, and painful affections of the large intestine, the opium clyster is most valuable.

14. *LINIMENTUM OPII*, L. E.; *Linimentum Opii vel Linimentum Anodynum*, D.; *Liniment of Opium*.—(Soap Liniment fʒvj; Tincture of Opium fʒij [of each fʒj, D.] Mix, L.—Castile Soap ʒvj; Opium ʒiiss; Camphor ʒiij; Oil of Rosemary fʒxj; Rectified Spirit Oij. Macerate the soap and opium in the spirit for three days; filter, add the oil and camphor, and agitate briskly, E.)—Employed as an anodyne in rheumatism, neuralgic pains, sprains, &c.

¹ See *Pharm. Journ.* for 1851, p. 250.

15. VINUM OPII, L. E. D., U. S.; *Laudanum Liquidum Sydenhami*, Ph. L. 1720; *Tinctura Thebaica*, Ph. L. 1745; *Wine of Opium*.—(Opium ℥ij, E. D.) [Extract of Opium ℥iiss, L. (℥ij, U. S.)]; Cinnamon, bruised; Cloves, bruised, of each ℥iiss [℥j, U. S.]; Sherry Wine Oij; [Wine Oj, U. S.] Macerate for seven, [fourteen, D. (U. S.)] days, and filter.—The Dublin College omits the spices. Its effects are similar to those of the tincture of opium, but its taste and smell are more agreeable. It was recommended by Mr. Ware¹ as an application to the eye in ophthalmia; and experience has fully proved its efficacy where there is much scalding pain, lachrymation, and intolerance of light. When first applied, it causes a sharp pain and a copious flow of tears, but these effects soon subside, and are followed by a considerable abatement of the former sufferings.—For internal use, the dose is gtt. x to f℥j.

16. TINCTURA OPII AMMONIATA, E.; *Ammoniated Tincture of Opium*.—(Benzoic Acid and Saffron, chopped, ℥vj of each; Opium, sliced, ℥ss; Oil of Anise ℥j; Spirit of Ammonia Oij. Digest for seven days, and filter.)—Employed as a powerful diffusible stimulant and antispasmodic in whooping-cough and other spasmodic affections. Each drachm and a quarter contains about a grain of opium.—Dose, f℥ss to f℥j.

17. ACETUM OPII, E. D. (U. S.); *Vinegar of Opium*.—(Opium ℥iv; Distilled Vinegar f℥xvj. "Cut the opium into small fragments, triturate it into a pulp with a little of the vinegar, add the rest of the vinegar, macerate in a closed vessel for seven days, and agitate occasionally. Then strain and express strongly, and filter the liquors," E.—The *Dublin College* uses one ounce and a half of Opium to one pint of Dilute Acetic Acid; macerates for seven days in a close vessel, with occasional agitation; strains, expresses, and filters.)—Vinegar dissolves all the principles of opium soluble in water, and is better adapted for holding in solution the narcotina and the resinous matter of opium. It cannot, of course, effect any change in the sulphate of morphia contained in opium. Whether any acetate of morphia is formed at the expense of the meconate of morphia has not been satisfactorily proved. The effects of vinegar of opium do not appear to be precisely those of ordinary opium. It is believed to possess the anodyne, sedative, and soporific qualities of opium, without being apt to excite the disagreeable effects (nausea, headache, constipation, and general disorder of system), which sometimes result from the ordinary preparation of this drug. Hill² says that Le Mort observed a very odd effect from this preparation, "which was, that it often brought on suppressions of urine." Dr. Montgomery³ has seen one instance of this effect; and Dr. Thomas Beattie⁴ has remarked the same result from the *Black Drop*. This paralyzing effect on the bladder is doubtless referable to the morphia, which seems to acquire, in this preparation, increased activity. Vinegar of opium is employed as an anodyne, sedative, and soporific. Dr. Montgomery observes that he has found this preparation of opium decidedly superior to every other in relieving the agony of cancer uteri, and procuring rest at night." The same authority states that twenty drops are equivalent to thirty of the common tincture of opium.—Dose, gtt. vj to gtt. xxx.

[The *U. S. Pharmacopæia* directs *Black Drop* (*Acetum Opii*, U. S.) to be prepared as follows: Take Opium, in coarse powder, eight ounces; Nutmeg, in coarse powder, an ounce and a half; Saffron half an ounce; Sugar twelve ounces; Distilled Vinegar a sufficient quantity. Digest the Opium, Nutmeg, and Saffron with a pint and a half of Distilled Vinegar, on a sand-bath, with a gentle heat, for forty-eight hours, and strain. Digest the residue with an equal quantity of Distilled Vinegar in the same manner for twenty-four hours. Then put the whole into a percolator, and pass and repass until the liquid is clear. When filtration ceases, pour on Distilled Vinegar to make three pints. Lastly, add the Sugar by means of a water-bath, evaporate to three pints and four fluidounces.—Dose, ℥x.]

¹ *Remarks on Ophthalmia*, p. 29, 1780.

² *Observ. on the Dubl. Pharm.* p. 451, 1830.

³ *Hist. of the Nat. Med.* p. 784, 1751.

⁴ *Dubl. Hosp. Rep.* vol. v. p. 185.

BLACK DROP.—*Acetum Opii* may be regarded as the officinal substitute for a celebrated quack medicine called the *Black Drop*, or *The Lancaster or Quaker's Black Drop*, the method of preparing which has been described by the late Dr. Armstrong. In this preparation, *verjuice* (juice of the wild crab) is employed instead of vinegar. But there are several sources of uncertainty in the process.

Dr. Porter's *solution of opium in citric acid* has never come into general use.

18. UNGUENTUM GALLÆ COMPOSITUM. (See Index.)
19. TINCTURA CAMPHORÆ COMPOSITA. (See Index.)
20. PILULÆ STYRACIS COMPOSITÆ. (See Index.)
21. PULVIS IPECACUANHÆ COMPOSITUS. (See Index.)
22. PILULÆ IPECACUANHÆ COMPOSITÆ. (See Index.)
23. PULVIS KINO COMPOSITUS. (See Index.)
24. ELECTUARIUM CATECHU. (See Index.)

c. Morphia and its Preparations.

1. MORPHIA, D.; *Morphina*, *Morphine*, *Morphium*.—So called from *Morpheus*, the god of sleep. Wedelius, Fr. Hoffman, and Neumann, speak of a *crystalline salt* obtained from a solution of opium; but they formed no correct notion of its nature. The *magistery of opium*, noticed by Ludwig, in 1688, may, perhaps, have been morphia.

Morphia is peculiar to the poppy tribe. It exists in opium in combination with meconic and sulphuric acids. Doubts, indeed, have been expressed with respect to its independent existence in opium, some chemists having suggested that it was a *product* rather than an *educt*; but it is now satisfactorily proved that there are no grounds for the supposition that it is a product.

[The *Dublin College* alone now admits morphia amongst its pharmaceutical preparations. The directions for preparing it are as follows:—

Take of Turkey Opium, cut into thin slices, ℞j; Distilled Water Ovj; Chloride of Calcium ʒvj; Prepared Animal Charcoal as much as is sufficient. Macerate the opium for twenty-four hours with a quart of the water, and decant. Macerate the residuum for twelve hours with a second quart of the water, decant, and repeat this process with the rest of the water, subjecting the insoluble residuum to strong expression. Let the decanted solutions and expressed liquor be evaporated by a steam or water-heat to the bulk of one pint, and then passed through a calico filter. Pour in now the chloride of calcium, first dissolved in four ounces of distilled water, and then proceed with the evaporation until the solution is so far concentrated that, upon cooling, nearly the whole of it becomes solid. Let this solid matter be enveloped in a couple of folds of strong calico, and subjected to powerful pressure, the dark liquid which exudes being reserved for subsequent use. The squeezed cake is now to be acted upon with about half a pint of boiling water, and the whole being thrown upon a paper filter, the precipitate must be well washed. The filtered solution having been evaporated as before, cooled and solidified, the residue is to be again subjected to expression. If the product be not quite white, this process should be repeated a third time, the liquid forced out during expression being always preserved. Let the squeezed cake be dissolved in six ounces of boiling water, and, if necessary, cleared by filtration through prepared animal charcoal, the portion of it soaked by the filter being carefully washed out of it; and to the solution thus obtained let water of ammonia be added, in slight excess, and let the crystalline precipitate, which forms when the liquor has cooled, be collected on a paper filter, and washed with cold distilled water until the washings cease to give a precipitate upon being dropped into an acid solution of nitrate of silver. Lastly, let the filter be transferred to a porous brick, in order that the morphia it contains may become dry.

The liquids separated by expression from the muriate of morphia in the preceding process, having been diluted with water, so as to occupy the bulk of four ounces, and then supersaturated slightly with ammonia, let the precipitate which forms be collected, after the lapse of six hours, on a filter, and washed with a little cold water. This, if redissolved in dilute muriatic acid, boiled with a little animal charcoal, and filtered, will, upon cooling, afford a crystalline deposit, from which, when pressed, dissolved in water, and supersaturated with ammonia, an additional quantity of morphia will be procured.—Ed.]

The following directions for preparing morphia were given in the former *London Pharmacopœia*. No directions are given in that for 1851.

Take of Hydrochlorate of Morphia $\mathfrak{z}\text{j}$; Solution of Ammonia $\mathfrak{z}\text{v}$; Distilled Water Oj. Add the Hydrochlorate of Morphia, first dissolved in a pint of water, to the solution of Ammonia with an ounce of water, shaking them together. What is thrown down wash with distilled water, and dry it with a gentle heat.

[The *U. S. Pharmacopœia* adopts a method recommended several years ago by Dr. Staples, of Philadelphia. The formula is: Take of Opium, sliced, a pound; Distilled Water, Alcohol, each a sufficient quantity; Solution of Ammonia six fluidounces. The Opium is to be macerated and worked with the water; the infusion evaporated to six pints and filtered; then five pints of Alcohol are to be added, and three fluidounces of Solution of Ammonia mixed with half a pint of Alcohol. Twenty-four hours afterwards the remainder of the Ammonia and the same quantity of Alcohol are to be added. By rest the crystals deposit. The Alcohol serves the purpose of suspending the colouring principles of the Opium, and renders the crystals purer. To purify them they may be dissolved in hot alcohol, and filtered through animal charcoal.]

In this process the ammonia unites with the hydrochloric acid, and the morphia being set free is precipitated.

Pure morphia presents itself under the form of transparent crystals, whose primary form is the right rhombic prism. On turmeric paper, as well as on reddened litmus paper, morphia has an alkaline reaction. Notwithstanding that it is insoluble, or nearly so, in cold water, it has a distinctly bitter taste. Boiling water dissolves a little more than one-hundredth part of morphia. It dissolves in 40 parts of cold anhydrous alcohol, and 30 parts of boiling alcohol; but it is insoluble, or nearly so, in ether. It is soluble in the oils (fixed and volatile), in solutions of potash and soda, and also, but in much smaller quantity, in solution of ammonia; lastly, it readily dissolves in sulphuric, hydrochloric, and acetic acids. When heated, the crystals lose their transparency and water of crystallization; a strong heat causes them to enter into fusion, in which state they form a yellow liquid similar to melted sulphur, and which becomes white and crystalline on cooling. Heated in the open air, it burns like resin, and leaves a carbonaceous residuum.

The following are the chief *characteristics* of morphia:—

1. *Nitric acid* reddens morphia or its salts (the chlorate excepted, according to Dumas), and forms with them an orange-red solution, which is much darkened by excess of ammonia, and which becomes yellow after a little time. By the prolonged digestion of morphia in nitric acid, we obtain oxalic acid.—*Fallacies*. Nitric acid produces a red colour with several other bodies, as brucia, commercial strychnia, several volatile oils (as oil of pimento and oil of cloves) some resinous substances, infusion of cloves or of pimento, &c.

2. *Iodic acid* is deoxidized by morphia, iodine being set free. Hence, when this alkali is added to a solution of iodic acid, the liquor becomes reddish-brown, and forms a blue compound (*iodide of starch*) with starch. *Fallacies*.—Sulphuretted hydrogen, sulphurous acid, phosphorous acid, sulphocyanide of potassium, sulphosinapisin, and some other agents, have a similar effect on iodic acid.

3. *Neutral sesquichloride of iron* dropped on crystals of morphia renders them blue. The same effect is produced on solution of salts of morphia when concentrated. The nature of the blue compound is not perfectly understood. Possibly part of the morphia is oxidized, and the compound thus produced unites with some oxide of iron (*morphite of iron*). If water in excess, or acids, or alkalies, be added to the blue compound, the colour is destroyed.—*Fallacies*. Tannic and gallic acids with a little water, and infusion of cloves or of pimento, also form blue compounds with sesquichloride of iron.

4. The *alkaline carbonates* occasion a white precipitate (*carbonate of morphia*) in solutions of the soluble morphitic salts.

5. *Solution of ammonia* precipitates morphia from its solution in acids. A considerable excess of ammonia redissolves the precipitate. In very dilute solutions, ammonia occasions no precipitate until heat be applied to drive off the excess of alkali.

6. *Infusion of nutgalls*, or a *solution of tannic acid*, causes a precipitate (*tannate of morphia*) in neutral solutions of the morphitic salts. The precipitate is soluble in acetic acid.

7. An alcoholic solution of *carbazotic acid* causes no precipitate in an alcoholic solution of morphia.

8. If a solution of *chlorine* be mixed with a solution of morphia, or its salts, and then ammonia added, a dark brown colour is developed.

9. If to a mixture of morphia and concentrated sulphuric acid a drop of bichromate of potash be added, green oxide of chrome is set free.—*En*]

10. A very sensitive test of the presence of morphia or its salts in solution is, to add a

drop or two of chloride of gold; a yellow precipitate falls, which on shaking is taken up; and if a drop of Liq. Potassæ be now added, it assumes various hues (according to the manipulation) first greenish, then bluish, then violet, and finally purple. The presence of morphia may be detected in a dilute coloured solution of opium, by simply dropping in the gold and potash without disturbing them; in the course of a few seconds, by placing a piece of white paper at the back of the vessel, purple clouds or streaks will be distinctly seen following the gold as it falls; the gold, in each instance, yields up its chlorine and is reduced; sometimes a blue black precipitate (oxide) is formed, varying according to the strength of the solution operated on.

The composition of morphia is, according to Regnault,¹ as follows:—

	Atoms.	Eq.Wt.	Per.Cent.		Atoms.	Eq.Wt.	Per.Cent.
Carbon . . .	35	210	71.91	Morphia	1	292	94.2
Hydrogen . .	20	20	6.85	Water	2	18	5.8
Nitrogen . .	1	14	4.80				
Oxygen . . .	6	48	16.44				
Morphia . .	1	292	100.00	Cryst. Morph. . .	1	310	100.00

Formula $C^{35}H^{20}NO^6$; Symbol $\overset{+}{M}$.

The *morphitic salts* are, for the most part, crystallizable. When pure, they are colourless. They have a bitter taste.

The following characters of the acetate and hydrochlorate of morphia are given in the *London Pharmacopœia* for 1851.

Acetate of Morphia (Sal ex Opio præparatus Crystalli).—Soluble in water and in rectified spirit, and, when the spirit is distilled from it, yields crystals, which are totally destroyed by heat. On the addition of Nitric acid, morphia becomes first red, and afterwards yellow. Tincture of sesquichloride of iron gives it a blue colour. Chlorine and [afterwards] ammonia being added to its salts, they are rendered of a brown colour, which is destroyed when more chlorine is added. Morphia is precipitated from its salts by solution of potash, which, added in excess, redissolves it.

[ADULTERATIONS.—Morphia is found contaminated with narcotina, codeia, and the colouring or resinoid matter of opium. Narcotina is best distinguished by the action of solution of caustic potash, which dissolves morphia but does not act on narcotina or codeia. Ether may be substituted, as this scarcely dissolves morphia, whereas it dissolves codeia and narcotina. The colouring or resinoid matter is detected by the colour of the morphia. If ammonia be added to a solution of hydrochlorate of morphia and codeia, the morphia is precipitated and the codeia left in solution. It is obvious that the process adopted by the Edinburgh College yields muriate of morphia contaminated with codeia.—ED.]

The precise relation which the effects of morphia and its salts bear to those of opium, is a point on which the profession is by no means agreed. Some recent writers² declare that, after having carefully compared the effects of the morphia salts with those of opium, they can discover no difference between them; but my own limited observation of the effects of these salts induces me to agree with those who admit the similarity, but not the identity, of the effects of these substances. Charvet³ could observe no difference between them in their action on the *invertebrata*. But on the higher classes of the *vertebrata* there were obvious differences. The effects of morphia on *man* are in several respects different from those of opium, but they appear to want uniformity; that is, the same results have not been arrived at by different experimenters. This may in some cases at least be ascribed to the employment of morphia contaminated with some other principles of opium. In small doses, as from a quarter of a grain to one grain, acetate of morphia causes a feeling of distension or fulness about the head, some disturbance of vision, oftentimes headache, giddiness and somnolency, or actual sleep, which, however differs from ordinary sleep, and is often more or less disturbed. The pupils are usually contracted. Orfila says this occurs in nineteen out of twenty cases. However, in some instances dilatation has been observed, and in others the pupil was natural. The pulse is generally slow and small, though sometimes it is more frequent, and

¹ *Pharmaceutisches Central-Blatt für 1838*, S. 486.

² Trousseau and Pidoux, *Traité de Thérap.* i. 164, 1836.

³ *De l'Action Comp. de l'Opium*, 1826.

occasionally is soft and full. Itching of the skin is frequently noticed, or even a cutaneous eruption is by no means uncommon. Grain doses readily excite gastric uneasiness, nausea, and vomiting. One remarkable symptom often caused by acetate of morphia, especially in men, is a difficulty in voiding the urine, and which appears to depend on a weakened or paralytic condition of the bladder. Bally¹ lays great stress on this last-mentioned symptom, especially when a full dose of morphia has been taken. When these effects subside, loss of appetite, muscular feebleness, and constipation are left behind. When the dose is increased, the effects become somewhat alarming. Great cerebral excitement is produced, vision is disordered and obscured, there is singing in the ears, and the patient, when lying horizontally, experiences sudden convulsive movements, like those produced by the electric shock. When a fatal dose has been swallowed, the stomach sometimes manifests irritation, but this is soon followed by great disorder of the cerebro-spinal system, which ultimately assumes an apoplectic character. The sight becomes dim, excessive weakness is experienced, gradually all consciousness is lost, and coma supervenes, attended usually with contracted, though sometimes with dilated pupils, coldness of the surface, frequent and small pulse, hurried stertorous respiration, and occasionally with convulsions. Before insensibility comes on, as well as when it is subsiding, there is itching of the skin. Difficulty in passing the water is also experienced, in consequence of the paralyzed state of the bladder. Not unfrequently, lividity of skin is observed.

The effects of morphia and its salts appear to be identical in their nature. The soluble salts (as the hydrochlorates) are more constant and certain in their operation than uncombined morphia, in consequence, probably, of the difficult solubility of the latter.

In comparing the morphitic salts with opium, we observe that they are less stimulant, and less disposed to cause sweating, constipation, headache, and dryness of the tongue. The feelings which they excite are less agreeable, and hence they are not adapted to be substituted for opium by the eaters of this drug. They more readily affect the bladder than opium.

USES.—We employ morphia, or its salts, in preference to opium, when our object is to make applications to the denuded dermis (*endemic medication*). They are employed in this way for the purpose of alleviating violent neuralgic pains, and to relieve the excessive endemic operation of strychnia. Gastrodynia and obstinate vomiting are sometimes relieved by the endemic application of morphia to the epigastrium; and violent headache by the application of this remedy to the temples. Occasionally, this mode of administration is adopted when we wish to bring the general system under the calming and sedative influence of morphia, and where from some cause its exhibition by the mouth is objectionable. Some cases of maniacal delirium may be treated with advantage this way.

The morphia salts are given internally in cases where we wish to obtain the anodyne, soothing, sedative, soporific, and antispasmodic qualities of opium, and where this drug is objectionable on account of its tendency to excite certain injurious effects already referred to. In all cases where both opium and the morphia salts are equally admissible, I prefer the former, its effects being better known and regulated; moreover, opium is to be preferred as a stimulant and sudorific, and for suppressing excessive mucous discharges.

ADMINISTRATION.—The salts are given internally, in a substance or solution, in doses of from one-eighth to one-fourth of a grain, or beyond this. I have given in insanity two grains of muriate of morphia at a dose. For endemic use they are to be finely powdered, and applied to the extent of a grain or a grain and a half at a time.

2. MORPHIÆ ACETAS, L. E. D. [U. S.]; *Acetate of Morphia*.—This salt was formerly directed to be prepared by the *London College* as follows:—

¹ *Mém. de l'Acad. Roy. de Méd.* i. 99.

Take of Morphia $\mathfrak{z}\text{vj}$; Acetic Acid $\mathfrak{f}\mathfrak{z}\text{ij}$; Distilled Water $\mathfrak{f}\mathfrak{z}\text{iv}$. Mix the Acid with the water, and pour them upon the morphia to saturation. Let the liquor evaporate with a gentle heat, that crystals may be formed.

In this process, the acetic acid saturates the morphia, and the solution by evaporation yields crystallized acetate of morphia.

The following are the directions of the *Edinburgh College* :—

“ Take of muriate of morphia any convenient quantity. Dissolve it in fourteen times its weight of warm water, and, when the solution is cool, add aqua ammoniac gradually, and with constant agitation, until there is a permanent but faint odour of ammonia in the fluid. Collect the precipitate on a calico filter, wash it moderately with cold water, and dissolve it by means of a slight excess of pyroligneous acid, in twelve parts of warm water for every part of muriate of morphia that was used. Concentrate the solution over the vapour-bath, and set aside to crystallize. Drain and squeeze the crystals, and dry them with a gentle heat. More acetate of morphia may be obtained on concentrating the mother liquor.”

In this process, the ammonia decomposes the muriate of morphia, and the precipitated morphia is afterwards dissolved in diluted pyroligneous (acetic) acid. In the *Pharmacopœia* of the *Dublin College* the following process is given :—

“ Take of Morphia, in fine powder, $\mathfrak{z}\text{j}$; Rectified Spirit $\mathfrak{z}\text{vii}$; Acetic Acid of commerce (sp. gr. 10.44) $\mathfrak{f}\mathfrak{z}\text{ivss}$, or as much as is sufficient. Pour the spirit on the morphia, and, applying heat, gradually add the acetic acid until a neutral or slightly acid solution is obtained. Let this be evaporated to the consistence of syrup by a steam or water heat, and then set by for a few days until it solidifies. In operations on the great scale, it will be worth while to remove the spirit by distillation.”

[Morphia (freed from Narcotina) $\mathfrak{z}\text{j}$; Distilled Water Oss; Acetic Acid, a sufficient quantity, *U. S.* Proceed as directed by *L. P.*]

Acetate of morphia is usually prepared by evaporating its solution to dryness by a gentle heat. Obtained in this way, it is amorphous. It is difficult to obtain it pure, as it readily undergoes decomposition, when its solution is evaporated, and is converted into a mixture of morphia, neutral acetate, and the superacetate of morphia. Hence, as met with in commerce, it is imperfectly soluble in water, unless a few drops of acetic acid be added. It is usually slightly coloured. Its crystals, when pure, are colourless and radiating. The following is the composition of this salt :—

	Atoms.	Eq. Wt.	Per Cent.
Morphia	1	292	82.95
Acetic acid	1	51	14.5
Water	1	9	2.55
Acetate of Morphia	1	352	100.00

Crystallized acetate of morphia is

Very readily dissolved in water. Its other properties are such as have been stated of morphia, *Ph. L.*

It is less soluble in alcohol than in water.

The *Edinburgh College* gives the following characters of the purity of this salt :—

One hundred measures of a solution of ten grains in half a fluidounce of water and five minims of acetic acid, heated to 212° , and decomposed by a faint excess of ammonia, yields by agitation a precipitate which, in twenty-four hours, occupies 15.5 measures of the liquid.

The dose of this and the other morphitic salts has been already mentioned.

[3. LIQUOR MORPHIÆ ACETATIS, *L.*; *Morphiæ Acetatis Liquor*, *D.*—(Solution of Acetate of Morphia. Take of Acetate of Morphia $\mathfrak{z}\text{iv}$; Acetic Acid $\mathfrak{m}\mathfrak{x}\text{v}$; Distilled Water Oj ; Proof Spirit Oss. Mix and dissolve, *L.* The dose of this solution is from $\mathfrak{m}\mathfrak{v}\text{j}$ to $\mathfrak{m}\mathfrak{x}\text{v}$.)—[Take of Acetate of Morphia eighty-two grains; Rectified Spirit five fluidounces; Distilled Water fifteen ounces. Having added the spirit to the water, dissolve the acetate of morphia in the mixture; and, if the solution is not quite clear, pass it through a paper filter.—*D.*]

4. MORPHIÆ HYDROCHLORAS, *L.*; *Morphiæ Murias*, *E. D.* [*U. S.*]; *Hydrochlorate* or *Muriate of Morphia*.—In the last *London Pharmacopœia* this salt is placed in

the *Materia Medica* as *Sal ex opio preparatus Crystalli*. In the former edition, it was directed to be prepared as follows:—

Take of opium, sliced, lb. j; Crystals of Chloride of Lead ℥ij, or as much as may be sufficient; Purified Animal Charcoal ℥iiss; Hydrochloric Acid; Distilled Water; Solution of Ammonia, each as much as may be sufficient. Macerate the opium in four pints of distilled water for thirty hours, and bruise it; afterwards digest for twenty hours more, and press it. Macerate what remains again, and a third time, in water, that it may become free from taste, and as often bruise and press it. Evaporate the mixed liquors, with a heat of 140°, to the consistence of a syrup. Then add three pints of distilled water, and, when all the impurities have subsided, pour off the supernatant liquor. Gradually add to this two ounces of chloride of lead, or as much as may be sufficient, first dissolved in four pints of boiling distilled water, till nothing farther is precipitated. Pour off the liquor, and wash what remains frequently with distilled water. Then evaporate the mixed liquors as before, with a gentle heat, that crystals may be formed. Press these in a cloth, then dissolve them in a pint of distilled water, and digest with an ounce and a half of animal charcoal, in a heat of 120°, and strain. Finally, the charcoal being washed, evaporate the liquors cautiously, that pure crystals may be produced. To the liquor poured off from the crystals first separated, previously mixed with a pint of water, gradually drop in as much solution of ammonia, frequently shaking it, as may be sufficient to precipitate all the morphia. To this, washed with distilled water, add hydrochloric acid, that it may be saturated; afterwards digest it with two ounces of animal charcoal, and strain. Lastly, the animal charcoal being thoroughly washed, evaporate the liquors cautiously, that pure crystals may be produced.

Water extracts from opium the *meconate* and *sulphate of morphia* and *codeia*; a part of the *narcotina*, of the *meconine*, of the *narceine*, and of the *thebaine*; the brown acid *extractive*; and a part of the *resin*, and of *fat oil*. When chloride of lead is added to infusion of opium, meconate, with a little sulphate of lead, and some resinous colouring matter, are precipitated, while the hydrochlorates of morphia and of codeia are left in solution. A solution of the impure crystals is then decomposed by ammonia, by which the morphia is precipitated, while codeia and hydrochlorate of ammonia are left in solution. The morphia is dissolved in hydrochloric acid, and the solution of the hydrochlorate decolorized by charcoal.

The *Edinburgh College* follows Gregory's process. Their directions for preparing this salt are as follows:—

“Take of Opium ℥xx; Water Oviij; Muriate of Lime ℥j, or a slight excess.—Macerate the opium in fragments for twenty four hours in two pints of water, and separate the infusion, squeezing well the residue. Repeat the maceration successively with two pints more of the water till the whole is made use of. Concentrate the whole infusion over the vapour-bath to one pint, and add the muriate of lime dissolved in four fluidounces of water. Set the whole aside to settle; pour off the liquid; wash the sediment with a little water, adding the washings to the liquid. Evaporate the liquid sufficiently in the vapour-bath for it to solidify on cooling. Subject the cooled mass to a very strong pressure in a cloth; redissolve the cake in a sufficiency of warm distilled water; add a little powder of white marble, and filter; acidulate the filtered liquor with a very little muriatic acid; and concentrate a second time in the vapour bath for crystallization. Subject the crystals again to very strong pressure in a cloth. Repeat the process of solution, clarification by marble and muriatic acid, concentration and crystallization, until a snow-white mass be obtained.

“On the small scale, trouble and loss are saved by decolorizing the solution of muriate of morphia by means of a little purified animal charcoal after two crystallizations. But on the large scale, it is better to purify the salt by repeated crystallizations alone, and to treat all the expressed fluids, except the first, in the same way with the original solution of impure muriate of morphia. An additional quantity of salt may often be got from the first dark and resinous fluid obtained by expression, on merely allowing it to remain at rest for a few months, when a little muriate of morphia may be deposited in an impure condition.

“The opium which yields the largest quantity of precipitate by carbonate of soda, according to the formula in p. 1034, yields muriate of morphia not only in the greatest proportions, but likewise with the fewest crystallizations.”

In this process, the changes are analogous to those before described for the process of the *London Pharmacopœia*, that meconate and sulphate of lime, instead of meconate and sulphate of lead, are produced.

The *Dublin College* gives the following directions:—

“Take of Morphia, in fine powder, ℥j; Pure Muriatic Acid ℥ivss, or a sufficient quantity; Distilled Water ℥iuss. Mix the acid with the water; heat to about 200°, and add the morphia, con-

stantly stirring, so that a solution may be formed having a slightly acid reaction. Set this to cool for 12 hours, and let the crystals, which separate, be drained of the liquor which surrounds them, and dried on blotting-paper. The decanted liquor will, by farther concentration and cooling, give additional crystals."

Another, and, as it is believed, a greatly improved method of obtaining morphia has been recently suggested by Mohr.¹ It consists in adding, to a concentrated infusion of opium, milk of lime, prepared with a quantity of dry lime, equal to the fourth part of the weight of the opium. The mixture is heated till it boils, and is filtered while hot through linen. The filtered liquor has a light brown yellow colour. While still hot, it is mixed with pulverized sal ammoniac in excess; the lime is saturated by the muriatic acid of the sal ammoniac, and the ammonia of the latter is set free, and the morphia precipitated. In this way crystallized morphia may be obtained without the use of alcohol.

Pure hydrochlorate of morphia crystallizes in plumose, acicular crystals. It is colourless, odourless, bitter, soluble in from 16 to 20 parts of cold water, but less of boiling water. When its saturated boiling solution is allowed to cool, it congeals to form a crystalline mass. It is soluble in alcohol. By heat, it is decomposed and totally dissipated. Nitric acid reddens it. Sesquichloride of iron with an alkali colours it blue.

The air-dried crystals are thus composed :—

	Atoms.	Eq. Wt.	Per Cent.
Morphia	1	292	76.24
Hydrochloric acid	1	37	9.66
Water	6	54	14.10
Crystallized Hydrochlorate of Morphia	1	383	100.00

According to the *London College*, crystallized hydrochlorate of morphia should be

Soluble in water and in rectified spirit. What is precipitated from the aqueous solution by the nitrate of silver is not entirely dissolved either by ammonia, unless added in excess, nor by hydrochloric acid, nor by nitric acid. It answers in other respects to what is stated above of the acetate of morphia.

The *Edinburgh College* gives the following characters of its purity :—

"Snow white; entirely soluble; solution colourless; loss of weight at 212° not above 13 per cent.; one hundred measures of a solution of 10 grains in half a fluidounce of water heated to near 212°, and decomposed with agitation by a faint excess of ammonia, yield a precipitate which, in twenty-four hours, occupies 12.5 measures of the liquid."

On the above, I would merely observe that Mr. Sandall² found that the quantity of water which this salt loses by drying varies from 9.20 to 14.33 per cent. The effects, uses, and doses of this, as well as the other morphitic salts, have been already described.

5. LIQUOR MORPHIÆ HYDROCHLORATIS, L.; *Morphiæ Muriatis Solutio*, E.; *Morphiæ Muriatis Liquor*, D.; *Solution of Muriate of Morphia*.—(Take of Hydrochlorate of Morphia ℥iv; Distilled Water Oj; Proof Spirit Oss. Mix and dissolve, L.—Muriate of Morphia ℥iiss; Rectified Spirit f℥v; Distilled Water f℥xv. Mix the spirit and water, and dissolve the muriate of morphia in the mixture with the aid of a gentle heat, E. D.)—About one hundred and six minims of this solution contain one grain of muriate of morphia.—The dose is from ℥x, gradually increased to f℥ss.

6. TROCHISCI MORPHIÆ, E.; *Morphia Lozenges*.—(Muriate of Morphia ℥j; Tincture of Tolu ℥ss; Pure Sugar ℥xxv. Dissolve the muriate of morphia in a little hot water; mix it and the tincture of tolu with the sugar; and, with a sufficiency of mucilage, form a proper mass for making lozenges; each of which should weigh about fifteen grains.)—Each lozenge contains about one-fortieth of a grain of

¹ *Athenæum* for 1840, p. 772; *Report of the Tenth Meeting of the British Association*, Lond. 1841; and *Berlinisches Jahrbuch*, Bd. xliii. S. 448.

² *Lond. Med. Gaz.* xxii. 186.

muriate of morphia. The morphia lozenges of the shops usually contain each one-twenty-fourth of a grain of muriate of morphia.—This is an agreeable mode of employing morphia, especially in pectoral affections.

7. **TROCHISCI MORPHIÆ ET IPECACUANHÆ**, E.; *Morphia and Ipecacuanha Lozenges*.—(Muriate of Morphia \mathfrak{zj} ; Ipecacuan., in fine powder, \mathfrak{zj} ; Tincture of Tolu $\mathfrak{f}\overline{\text{ss}}$; Pure Sugar $\mathfrak{z}\overline{\text{xxv}}$. Dissolve the muriate in a little hot water; mix it with the tincture and the ipecacuan. and sugar; and, with a sufficiency of mucilage, beat the whole into a proper mass, which is to be divided into fifteen-grain lozenges.)—Each lozenge contains about one-fortieth of a grain of muriate of morphia, and one-thirteenth of a grain of ipecacuanha. Useful to allay tickling cough.

8. **MORPHIÆ SULPHAS** [U. S.]; *Sulphate of Morphia*.—This salt, though not contained in the British pharmacopœia, is occasionally used in medicine. It is crystalline, and readily soluble in water. It consists of 1 atom *sulphuric acid*=40, 1 atom *morphia*=292, and 6 atoms *water*=54. One of these atoms of water is an essential constituent of the salt, and cannot be removed without destroying the salt. The other 5 atoms are the water of crystallization. The dose of it is the same as the other morphitic salts.

9. **[THE LIQUOR MORPHIÆ SULPHATIS, [U. S.]** *Solution of Sulphate of Morphia* is made in the proportion of one grain to the ounce of water. Dose, $\mathfrak{f}\overline{\text{zj}}$ to $\mathfrak{f}\overline{\text{zjij}}$.]

[338. SANGUINARIA CANADENSIS, Linn.—BLOODROOT.

Sex. Syst. Polyandria, Monogynia.
(*Sanguinaria*, U. S. The Root.)

Gen. Char.—*Calyx* pentaphyllous, deciduous. *Petals* eight. *Stigma* sessile, two-grooved. *Capsule* superior, oblong, one-celled, two-valved, apex attenuated. *Receptacles* two, filiform, marginal (*Nuttall*).

Sp. Char.—*Root* tuberous, horizontal, giving out a reddish and a very acrid lactescent sap. *Leaves* solitary, radical, reniform and lobed. *Scape* naked, one-flowered, sheathed at base. *Petals* variable in number. April. Perennial.

This plant is called *Bloodroot*, from the red colour of its root, which, when wounded, pours out a quantity of red viscid juice. The same issues from the stalks of the leaves and flowers, but to a less amount. It is also known by the name of *Puccoon*. It grows throughout the United States, appearing in open woods at an early period of the spring, which it highly ornaments by its handsome white flowers.

The root is horizontal, from an inch to two inches in length, and half an inch in diameter, thicker at the summit, terminating abruptly as if bitten off (*præmorse*), fleshy, succulent, and beset with slender red fibres or radicles. It is taken from the ground during the summer, and when dried becomes dark-brown externally, contracted, wrinkled, somewhat twisted. It breaks with a short, waxy fracture, presenting an orange-red colour upon the fractured surfaces. Its odour is feebly narcotic, disagreeable, but lost in a measure by drying. Its taste is acrid and bitter.

The powder is grayish-red.

COMPOSITION.—No detailed account of the constituents of this root has been presented, but Dr. Dana of New York has obtained from it an alkaline substance, which is probably the active principle of the root.

SANGUINARINA (*Dana*).—This principle is obtained by digesting the finely-powdered root in absolute alcohol, and adding to the solution ammonia, so long as a precipitate is thrown down. This is boiled in water with animal charcoal, and filtered; what remains on the filter is digested in alcohol, and dried by evaporation. A *white pearly substance* remains. It has an acrid taste, renders the yellow of turmeric brown, and changes the infusion of purple cabbage green. It is sparingly soluble in water, but soluble in ether and alcohol. With tincture of galls it affords a precipitate soluble in alcohol, but insoluble in ammonia. It combines with acids and forms salts, which all present some shade of red, crimson, or scarlet of great intensity of beauty. (*Smith, in Journ. of Philada. Col. of Pharm.* vol. iii. p. 95.)

MEDICAL PROPERTIES.—No experiments upon animals have been made with Bloodroot to determine the effect it is capable of producing. It is stated that

farriers sometimes give it to horses, in order to produce sweating, and facilitate the shedding of their hair. (*Downey's Essay*, p. 30.)

On man it produces effects which are characterized by considerable energy. In 1803, Sanguinaria was made the subject of an Inaugural Essay, by Dr. Downey, of Maryland, which appears to be the first attempt to determine its operation. Twenty grains of the recent root, and eight grains of the alcoholic and watery extracts, induced nausea and vomiting, with more or less sensation of warmth and heat in the stomach, acceleration of pulse, and in several experiments, a slight degree of headache. An acrimonious impression was uniformly made upon the fauces, and in several instances it acted on the bowels. The leaves are endowed with similar powers, and the seeds exert a marked power over the brain and nervous system, occasioning torpor, languor, disordered vision, and dilatation of the pupils. These statements have been confirmed by subsequent investigation, and consequently Bloodroot must be regarded as a stimulant, acrid emetic, and narcotic; a diaphoretic effect when produced must be accessory to these effects. In large doses, the "emesis is violent, there is a burning sensation in the stomach, faintness, vertigo, dimness of vision, and alarming prostration." (*United States Dispensatory*.) The disease in which it has been employed are those of the lungs, as pneumonia, catarrh, phthisis, croup, &c. It has also been used in rheumatism and in jaundice, but in the latter disease must be a remedy of questionable propriety. It was known to Dr. Shöff, who speaks of the employment of a decoction in gonorrhœa.

The mode of exhibition is in powder, the dose as an emetic being 20 grains; the form of pill is preferable, on account of the acrimony. As a stimulant and alterant, doses of 5 grains may be given every 3 or 4 hours. The infusion or decoction may be made in the proportion of ʒss to Oj of water.—Dose, fʒss to fʒi.

TINCTURA SANGUINARIÆ, [U. S.] *Tincture of Bloodroot*.—Bloodroot, bruised, four ounces; Diluted Alcohol two pints. Macerate for fourteen days, and filter through paper or prepare by displacement. Dose, fʒss to fʒj. As an emetic, fʒss.]

ORDER LXXXVI. MENISPERMACEÆ, *De Candolle*.—THE COCCULUS TRIBE.

MENISPERMEÆ, *Jussieu*.

CHARACTERS.—*Flowers* (by abortion?) unisexual, usually diœcious, very small. *Floral integuments* in one or several rows, each of which consists of three or four parts, hypogynous, deciduous. *Petals* sometimes absent. *Males*; *stamens* monadelphous, or rarely distinct; sometimes equal in number, and opposite to the petals; at other times three or four times as many; *anthers* adnate, turned outwards, or inserted on the apex of the filament. *Females*; *ovaries* sometimes numerous, each with one style cohering slightly at the base; sometimes solitary, crowned with many stigmas, internally many-celled, and, therefore, consisting of many carpels soldered together. *Drupe*s usually berried, 1-seeded, oblique or lunate, compressed. *Seed* of the same shape as the fruit; *embryo* curved or turned in the direction of the circumference; *albumen* 0, or small and fleshy; *cotyledons* flat, sometimes lying face to face, sometimes distant from each other, and lying in two cells of the seed!; *radicle* superior, but sometimes appears inferior, when the apex of the fruit is, by the mode of growth, contiguous with the base.—Sarmentaceous flexible rough *shrubs*. *Leaves* alternate, simple or rarely compound, mucronate. *Flowers* small, usually racemose. (*De Cand.*)

PROPERTIES.—The roots of several species are bitter and tonic; the seeds of some of them are narcotic.

339. COCCULUS PALMATUS, De Candolle, L. E.—THE CALUMBA PLANT.

Menispermum palmatum, Lamarck.

Sex. Syst. Diœcia, Hexandria.

(*Radix*, L.—Root, E. D.)

[*Columba*, U. S.]

HISTORY.—Franciscus Redi,¹ in 1675, is the first writer who mentions the root of this plant; he praises it as an alexipharmic or antidote for poisons. Cartheuser afterwards examined it; but Dr. Thomas Percival² gave the best account of it. This root has been known by various names—such as *Calumba*, *Colombo*, *Calomba*, and *Colomba*. Its native country and history were long involved in obscurity. In 1830, Dr. Hooker³ published a complete description of both the male and female plants. The root was at first supposed to come from Colombo, a town of Ceylon, and from which it was said to derive its name. But it is now known to be the produce of Mozambique. Its English name, *Calumba*, is derived from the Portuguese word *Kalumbo*, the *o* in which is mute.⁴

BOTANY. *Gen. Char.*—*Flowers* unisexual, (always?) diœcious. *Calyx* of 12 sepals in four series, with 2, 3, or more close-pressed bracteoles. *Males*; *stamens* 6, or rarely 3, opposite to the inner sepals, distinct; *anthers* 2-celled, terminal, dehiscing vertically; *filaments* either filiform with the anther cells horizontal, approximate, and each externally 2-lobed, or thickened at the apex with the cells diverging downwards, and separated by the connective. *Females*; *ovaries* 3, 6, or numerous. *Drupes* 1 to 6, or numerous, 1-celled, 1-seeded. *Peduncles* axillary or rarely lateral; males usually many-flowered; females generally few-flowered, without bracts, or with very small ones if present (Lindley).

Sp. Char.—*Leaves* cordate at the base, 5- to 7-lobed; lobes quite entire, acuminate, somewhat hairy. *Stems* and *ovaries* clothed with glandular hair. (De Cand.)

Root perennial, of several fasciculated, fusiform, fleshy tubers, with a brown warty epidermis; internally deep yellow, odourless, very bitter. *Stems* annual, herbaceous, twining, beset at the lower part with long glanduliferous hairs: of the males, simple; of the females, branching. *Leaves* alternate, nearly orbicular, wavy on the margin, with long hairy footstalks. *Racemes* axillary, solitary; in the male plants compound. *Flowers* small, green. *Fruit* drupaceous or berried, about the size of a hazel-nut, densely clothed with long spreading hairs, tipped with a black oblong gland.⁵

Hab.—Thick forests on the shores of Oibo and Mozambique, as well as inland for 15 or 20 miles.

PREPARATION OF THE ROOTS.—The natives never cultivate the plant, the spontaneous produce being sufficient. The roots are dug up in March (the hot season), the offsets from the main root are cut in slices, strung on cords, and hung up to dry in the shade. It is deemed fit for commerce when, on exposure to the sun, it breaks short; and of a bad quality when it is soft or black.

DESCRIPTION.—*Calumba* or *Colombo* root (*radix calumbæ*) is met with in flat circular or oval pieces, of from half an inch to three inches in diameter, and from one to three or four lines thick. It occurs also in cylindrical pieces of from one to two inches long. The epidermis covering the sides of the pieces is of a yellowish-

Fig. 417.



Cocculus palmatus.
(Male plant.)

¹ *Exp. circa varias res nat.* p. 179.

² *Bot. Mag.* 2970—71.

³ Bojer, in Hooker's *Bot. Mag.* tt. 2970—71.

² *Med. Essays*, vol. ii. p. 3. 1773.

⁴ Berry, *Asiatic Researches*, x. 385.

gray or brownish colour, smooth, or irregularly rugous. The transversal surfaces are of a greenish or grayish-yellow colour, depressed in the middle from the great shrinking of the medulla in the drying process, and consist of three or four concentric layers. The outer or cortical portion varies in thickness, but is usually about two or three lines thick. It is separated from the ligneous portion by a dark-coloured layer, not exceeding a hair in thickness. The internal or medullary portion is light, spongy, and shrunk. The odour of calumba is faint, but somewhat aromatic; the taste aromatic, and very bitter. In the larger and thicker pieces small holes are occasionally observed, which have been made for the convenience of drying. On account of the starch which it contains, the root is readily attacked by insects.

I am indebted to Mr. N. B. Ward for a sample of calumba root cultivated at the Mauritius. It is deficient in the bright greenish-yellow tint of the Mozambique calumba.

COMMERCE.—In the year 1838, duty (2*d.* per lb.) was paid on 19,805 lbs., and in 1839, only on 9384 lbs. of calumba.

COMPOSITION.—The more recent analyses of Calumba root are those of Planchet and Buchner.²

	Planche.	Buchner.
Bitter matter	13	10 to 12.2
Animal matter, soluble in water and not in alcohol	6	0
Yellow resinous extractive	0	5.0
Volatile oil	a trace.	0.0
Wax	0	0.2
Gum	9	3.8 to 4.7
Starch	33	30 to 35
Vegetable medulla [pectin?]	0	17.4
Woody fibre	39	12.6
Water	0	9.8
Loss		?
Calumba Root	100	100

1. **ODOROUS PRINCIPLE (Volatile Oil &c).**—The odour of the root is supposed to depend on a volatile oil, traces of which were procured by Planche. The distilled water of the root possesses the odour of the latter.

2. **CALUMBIN (Bitter Principle)**—A crystallizable, odourless, very bitter, neutral substance, extracted from Calumba root by Wittstock.³ Its crystals are rhombic prisms. It is fusible; very slightly soluble in water, alcohol, ether, and volatile oils. Boiling rectified spirit dissolves about 1-40th of its weight. It dissolves in acids and alkalies, its best solvent being acetic acid. It is unaffected by metallic solutions, and by infusion of nutgalls. Sulphuric acid dissolves it, assuming first a yellow, then a red colour. Its composition, according to Liebig, is carbon 65.45, hydrogen 6.18, oxygen 28.37; or $C^{12}H^7O^4$.

Planche describes the active principle of calumba as a *yellow bitter matter* soluble in water and alcohol, and yielding no precipitate either with the salts of lead or infusion of galls.

3. **STARCH.**—This constitutes about one-third by weight of the root. It renders the root an easy prey to insects. The structure of the starch particles has been described by Payen.⁴ These bodies are remarkable by their gibbositities, and by the hilum being found on the largest part of the particles.

CHEMICAL CHARACTERISTICS.—If the root be moistened with water, and then touched with tincture of iodine, it becomes black. A decoction of the root, when cold, forms with a solution of iodine a blue colour (*iodide of starch*). Sulphate of iron, emetic tartar, and gelatine, produce no obvious change in an infusion of calumba, showing the absence of tannic and gallic acids. Litmus detects no free acid. Infusion of nutgalls causes in the infusion of calumba a precipitate (*tannate of starch?*).

¹ *Bull. de Pharm.* iii. 189.

² *Ibid.* 1830, S. 517.

³ *Pharm. Central-Blatt für 1831*, S. 429.

⁴ *Ann. Scient. Nat. Botany*, July 1838, p. 20.

ADULTERATION.—The root of *Frasera Walteri*, called the *American* or *false calumba*, has been occasionally substituted for calumba root on the continent. Such a fraud would not be practicable in England, at least to any extent, as the appearance of the root is quite dissimilar to that of the genuine calumba. It is distinguished chemically from the latter by three characters: 1st, it undergoes no change of colour when touched with tincture of iodine, showing that it contains no starch; 2d, it becomes blackish-green on the addition of sulphate of iron; 3d, it yields a precipitate with a solution of gelatine. The two last characters indicate the presence of tannic acid.

PHYSIOLOGICAL EFFECTS.—Calumba is an excellent tonic, promoting the appetite, assisting the digestive process, and improving the quality of the secretions from the gastro-intestinal mucous membrane. It is not a stimulant; for Dr. T. Percival took a scruple of it on an empty stomach, but did not observe that it had the least effect on the regularity, fulness, or velocity of the pulse. In another experiment, he swallowed half a drachm; in ten minutes his pulse was fuller and slower by three beats, and continued so for three-quarters of an hour. In consequence of the quantity of starch and gum which it contains, it is sometimes termed a *mucilaginous* or *demulcent tonic*. *Cetraria islandica* and Simaruba bark agree with calumba in this circumstance. But from them, as well as from quassia, it is distinguished by its aromatic properties. In some respects (*i. e.* in its tonic and aromatic qualities) it approximates to rhubarb, but is devoid of the purgative and astringent properties of the latter. Its want of astringency distinguishes it from the astringent tonics (as cinchona). Full doses of it, in the form of powder, given when the stomach is very irritable, cause vomiting. It does not appear either to constipate or relax the bowels. We are not acquainted with the effects of excessive doses of it. Poisonous properties have been assigned to it by Buchner,¹ who states that Härtl, one of his pupils, applied a grain of the ethereal extract of calumba, deprived of wax by repeated solution in water, to a wound in the leg of a rabbit, and that it proved fatal in ten hours.

USES.—Calumba is one of our most useful stomachics and tonics. Its great value consists in its not being apt, like other and more powerful tonics, to create nausea, sickness, febrile disorder, or headache, so that it is tolerated when other remedies of this class would be immediately rejected. Indeed, on many occasions it evinces a positive power of checking vomiting. Schwilgué,² in order to test its anti-emetic qualities, gave it when vomiting had commenced after the use of emetic tartar and ipecacuanha. It frequently arrested the vomiting. He also gave it in conjunction with these emetics, and observed that the vomiting occurred more slowly than usual, and was milder. Probably it owes these valuable properties to a combination of circumstances; such as its freedom from acidity and astringency, the large quantity of starch which it contains (from which it acquires demulcent properties), and the peculiar operation of its bitter principle. The following are the principal uses to which it has been applied:—

1. *In a languid state of the stomach, with general debility*, attended with want of appetite, indigestion, nausea, and flatulence, experience has fully established the value of calumba, and has proved the justice of the encomiums passed on it by Dr. T. Percival. It is of all tonics the least likely to disagree with the stomach. In the stage of convalescence after an attack of fever, the infusion of calumba is an excellent preparative for the more powerful tonics (infusion of cinchona and disulphate of quina). In those forms of dyspepsia attended with great acidity of stomach, it may be given with advantage in combination with bicarbonate of potash.

2. *To allay vomiting*, when not dependent on inflammatory conditions of the stomach, calumba is often highly serviceable; as in bilious vomiting, in the sickness which so frequently attends pregnancy, and dentition. Even vomiting arising from renal calculi or diseased kidney has been somewhat palliated by calumba. I

¹ *Toxicol.* S. 229.

² *Mat. Méd.* ii. 374.

have seen the most satisfactory results from the combined use of infusion of calumba and effervescing draughts (composed of citric acid and bicarbonate of potash) in those occasional attacks of vomiting especially observed in delicate females, and which are commonly termed bilious attacks. By this treatment the violence and continuance of the vomitings have been diminished, and the continued employment of calumba has reduced the frequency and in some cases prevented the occurrence of future attacks.

3. *In diarrhœa and dysentery*, where tonics are admissible, as in the later periods of these diseases, when the inflammatory symptoms have subsided, and in habitual diarrhœa, calumba often proves serviceable. In Germany, it is denominated *Ruhr-wurzel* (i. e. *dysenteric root*).

ADMINISTRATION.—Calumba is administered in the form of *powder, infusion, or tincture*. The dose of the *powder* is from gr. x to ʒss. The *infusion* is the most eligible form of exhibition.

1. **INFUSUM CALUMBÆ**, L. E. [U. S.]; *Infusum Colombæ*, D.; *Infusion of Calumba*. —(Calumba, sliced [in coarse powder, *E. D.*], ʒv [ʒss, *E. (U. S.)*; ʒiij, *D.*]; Boiling [distilled, *L.*] Water [Cold Water, *E. D.*] Oj [ʒix, *D.*]. Macerate for two hours in a lightly covered vessel, and strain, *L. D.*—"Triturate the calumba with a little of the water, so as to moisten it thoroughly, put it into a percolator, and transmit cold water till fʒxvj of infusion be obtained," *E.*)—The facility with which this preparation undergoes decomposition is ascribed by Planche to the substance which he terms *animal matter*.—Dose of the infusion, fʒj to fʒij. It may be conjoined with alkalies or chalybeates, without injury or obvious change. [Infusion of calumba becomes muddy by allowing it to stand on the dregs.—*Ed.*]

2. **TINCTURA CALUMBÆ**, L. E.; *Tinctura Colombæ*, D.; *Tincture of Calumba*. —(Calumba, sliced [in small fragments; if by percolation in moderately fine powder, *E.*], ʒiij [ʒv, *D.*] [ʒiv, *U. S.*]; Proof Spirit [Diluted Alcohol, *U. S.*] Oij. Macerate for seven days [fourteen, *D.*], and filter.—"Express the residuum strongly, and filter the liquors. This tincture is much more conveniently prepared by the process of percolation, allowing the powder to be soaked with a little of the spirit for six hours before putting it into the percolator," *E.*—An excellent adjunct to bitter infusion and effervescent medicines, when given to check vomiting.—Dose, fʒj to fʒij.

340. ANAMIRTA COCCULUS, *Wight and Arnott, E.*—THE COCCULUS INDICUS PLANT.

Sex. Syst. Dicoecia, Monadelphia.
(Fruit, *E.*)

HISTORY.—"According to Sprengel,¹ the fruit now usually called *Cocculus indicus* was introduced by the Arabians, and was described by Avicenna and Serapion under the name of *Muheradsch*."² In my copy, however, of the Latin translation of Avicenna,³ the word *Muheradsch* does not occur, but *Mahezeheregi*, or *Mahezhera*,⁴ is said to intoxicate fish. Nor can I find it in Serapion. *Cocculus indicus* is sometimes termed the *Levant nut*, or *bacca orientalis*.

BOTANY. Gen. Char.—*Flowers* dioecious. *Calyx* of 6 sepals in a double series, with 2 close-pressed bracteoles. *Corolla* 0. *Male*: *stamens* united into a central column dilated at the apex; *anthers* numerous, covering the whole globose apex of the column. *Female*: *flowers* unknown. *Drupe* 1 to 3, 1-celled, 1-seeded. *Seed* globose, deeply excavated at the hilum; *albumen* fleshy; *cotyledons* very thin, diverging.—*Twining plants*, with a corky bark. *Leaves* more or less cordate-ovate. *Flowers* in lateral compound racemes (*Wight and Arnott*).

¹ *Berl. Jahrb.* xxiii. 1822, S. 70.

² *Venet* 1564.

³ *Schwartz, Pharm. Tabell.* S. 38, 2te Ausg.

⁴ *Lib.* 2ndus, tr. 2ndus, cap. 468.

Sp. Char.—The only species.

A strong climbing shrub. Bark deeply cracked, ash-coloured. Leaves stalked, large (from 8 to 12 inches long); petiole a little shorter than the leaves.

Hab.—Malabar, and Eastern Islands, &c. of India.

DESCRIPTION.—As met with in commerce, *Cocculus indicus* (also called *Cocculus levanticus* seu *piscatorius*) has considerable resemblance to the bay berry (*vacca lauri*), but is scarcely so large as the latter. It consists externally of a dried, thin, blackish-brown, rugous, acrid, and bitter layer, which envelops a thin, bivalved, white, ligneous shell (*endocarp*). In the middle of this shell arises a central placenta, which is contracted at its base, but enlarged and divided into two cells superiorly. Between this placenta and the shell is an oleaginous, yellowish, very bitter nucleus (*seed*), of a semilunar form. This nucleus never wholly fills the cavity of the shell—at least in the *Cocculus indicus* of commerce; for by keeping, it gradually becomes atrophied, and in old samples it is not uncommon to find the shell almost empty. This change is observed also in other oleaginous seeds. By this character alone *Cocculus indicus* may be instantly distinguished from the bay berry. The *Edinburgh College* requires that—

“The kernels should fill at least two-thirds of the fruit.”

COMMERCE.—*Cocculus indicus* is imported in bags from Bombay, Madras, and Ceylon. I am not acquainted with any official returns of the quantity annually brought over. From a druggist's private books I find that, in 1834, about 2,500 bags entered; and this probably is much below the quantity imported. The greater part is consumed for illegal purposes—principally for adulterating beer and ale, though this practice is prohibited by the legislature, under a penalty of £200 upon the brewer, and £500 upon the seller of the drug.

COMPOSITION.—*Cocculus indicus* was examined in 1811 by Boullay,¹ and in 1834 by Pelletier and Couerbe.² The results obtained by the last-mentioned chemists were as follows:—

Analysis of the Nucleus.

1. Picrotoxin.
2. Resin.
3. Gum.
4. A fatty acid substance.
5. An odorous matter.
6. Malic acid.
7. Mucus.
8. Starch.
9. Lignin.
10. Waxy matter.
11. Inorganic substances (nitrate and sulphate of potassa, and chloride of potassium), by incineration carbonates of potash, and of lime, manganese, and iron.

Analysis of the Shell.

1. Menisperm. .
2. Paramenisperm. .
3. Yellow alkaline matter.
4. Hypopicrotoxic acid.
5. Wax.
6. Starch.
7. Chlorophylle.
8. Resinous matter.
9. Gum.
10. Fatty matter.
11. Inorganic substances (as those of the nucleus with the addition of copper).

1. **PICROTOXIN** (*Picrotoxic Acid*).—At first, it was supposed to be an alkaline substance, and was termed *picrotoxin*. It is a white, crystalline, intensely bitter substance, usually crystallizing in needles, but sometimes in silky flexible filaments or transparent plates, or granular crystals. It is soluble in 150 parts of water at 57° F., in 25 parts of boiling water, in a third of its weight of alcohol, and in less than half its weight of ether. It is insoluble in the fixed and volatile oils, but is soluble in acetic acid. It does not combine with acids, but forms combinations with alkalis. It seems, therefore, to be an acid, though a feeble one. It consists of C¹²H⁷O⁵. The poisonous properties of the nucleus (seed) of *cocculus indicus* depend on picrotoxin. [Dr. Glover has recently experimented on the properties of this substance, and has published an account of his experiments in the *Lancet*.³ According to the analysis of Dr. Francis, it contains nitrogen, and it consists in 100 parts of carbon 60.26, hydrogen 5.70, nitrogen 1.30, oxygen 32.74.—En.]

2. **MENISPERMIA** (*Menispermia*; *Menispermine*).—This is an opake, white, crystalline substance, soluble in alcohol and ether, but insoluble in water. It fuses at 248° F., and at a higher temperature is decomposed, leaving an abundant charcoal. It dissolves in and saturates acids; and from these solutions alkalis precipitate it. Concentrated sulphuric acid has little action on it; hot nitric acid converts it into a yellow resinous substance, and oxalic acid. It is composed,

¹ *Ann. de Chim.* lxxx. 209.

² *Lancet*, Jan. 11, 1851, p. 47.

² *Ann. Chim. et de Phys.* liv. 181.

according to Gay-Lussac, of $C^{18}H^{12}NO^2$. It does not appear to have any marked action on the animal economy.

3. *PARAMENISPERMIA* (*Paramenispermina*; *Paramenispermine*).—This is a crystalline solid, insoluble in water, scarcely soluble in ether, but dissolving readily in alcohol. It is fusible and volatile, and may be sublimed unchanged. It does not saturate acids, and, therefore, differs in this respect from the preceding substance. Notwithstanding this, however, its composition is the same.

4. *HYPOPICTOTOXIC ACID*.—This acid is an amorphous, brown solid, insoluble in water (cold or boiling), insoluble in ether, soluble in alkalies, and precipitable from its solution in them by the mineral acids. It is composed of, carbon 64.14, hydrogen 6.09, oxygen 29.77. This composition approximates to that of picrotoxin.

The yellow alkaline matter of the shell has been scarcely examined.

Boullay¹ mentions a crystalline substance which he calls *menispermic acid*; but its properties require farther examination²

CHEMICAL CHARACTERISTICS.—Iodine colours the nucleus brown. The cold watery infusion of the whole fruit is slightly acid, and produces a dark precipitate with the sesquichloride of iron. Infusion of galls also occasions a precipitate.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—A solution of the aqueous extract of *Cocculus indicus* killed a haricot plant in twenty-four hours.³

β. On Animals generally.—It is poisonous to all animals; at least it has been found to be poisonous to dogs, goats, cows, crocodiles, birds, and insects. Goupil⁴ considered it to be a local irritant; but the correctness of this opinion is denied by Orfila.⁵ When introduced into the stomach its irritant effects were confined to the production of nausea and vomiting. It acts on the cerebro-spinal system, causing staggering, trembling, tetanic convulsions, and insensibility. Goupil states that all fish which eat it die—roach being killed very easily, barbel with more difficulty. "The barbel," we are told, "is, of all fish, that whose flesh the most frequently occasions accidents in those animals who eat it; probably because these fish, taking a longer time to die, the poison is longer subjected to the action of the digestive juices, and a considerable quantity of it is consequently absorbed." Orfila says, *Cocculus indicus* acts like camphor on the nervous system, and principally on the brain.

γ. On Man.—Its effects on man have not been accurately ascertained. Hill⁶ says, three or four grains of it have brought on nausea and faintings. It is frequently added to malt liquors, for the purpose of increasing their intoxicating powers; but, from some accounts which I have received from an Excise officer, who has been repeatedly subjected to the influence of beer thus adulterated, its action appeared to be rather on the voluntary muscles than on the intellectual powers.

The operation of *Picrotoxine* is analogous to, though stronger than, that of *Cocculus indicus*. Ten or twelve grains, given by the mouth, are sufficient to kill a dog. A grain and a half, injected into the jugular vein of a dog, killed the animal in twenty minutes.

USES.—*Cocculus indicus* is rarely employed in medicine. It has, however, been used as an external application, in the form of powder or ointment, to destroy pediculi (hence the Germans call these fruits *Läusekorner*, or *louse-grains*). It has also been employed in some obstinate skin diseases, as porrigo; but its use requires caution, especially where the skin is not entire, on account of the danger of absorption. Notwithstanding the severe prohibitory statutes against the employment of *Cocculus indicus* in brewing, I have reason to believe that it is extensively used; but being employed in the form of a solution of the extract, the form is not easy of detection. Morrice⁷ gives full directions for its employment. In the manufacture of porter, this author directs three pounds of *Cocculus indicus* to be added to every ten quarters of malt. "It gives," says he, "an inebriating quality, which passes for strength of liquor;" and he adds, "that it prevents second fermentation in bottled beer, and consequently the bursting of the bottles in warm climates."

¹ Journ. de Pharm. xiv. 61.

² Marceet, *Ibid.* xxix. 215.

³ *Ibid.*

⁴ Treatise on Brewing.

⁵ See Casaseca, *Ann. Chim. et Phys.* xxx. 307.

⁶ Quoted by Orfila, *Toxicol. Gén.*

⁷ *Hist. of the Mat. Med.*

ANTIDOTE.—In poisoning by *Cocculus indicus*, or picrotoxin, remove the poison from the stomach as speedily as possible. No chemical antidote is known, though acetic acid has appeared to give relief. The symptoms must be combated on general principles, no peculiarities in the treatment being known. As a last resource, try artificial respiration.

UNGUENTUM COCCULI, E. ; *Ointment of Cocculus Indicus.*—(Take any convenient quantity of *Cocculus indicus*, separate and preserve the kernels; beat them well in a mortar, first alone, and then with a little axunge, and then add axunge till it amounts, altogether, to five times the weight of the kernels.)—Used to destroy pediculi.

Jager¹ has an *ointment of picrotoxin* (composed of gr. x of picrotoxin and 3j of lard) in obstinate forms of porrigo.

341. CISSAMPELOS PAREIRA, Linn. E. D.—PAREIRA BRAVA, OR VELVET LEAF.

Sæ. Syst. Diœcia, Monadelphia
(Radix, L.—Root, E. D.)

HISTORY.—The root of this plant was first mentioned by Piso² in 1648, under the name of *Caupêba*. It was introduced into Paris, in 1689, by M. Amelot, the French ambassador at Portugal.³

It is usually termed *Pareira* (Parreyra) *brava*, which means, literally, *wild vine*, on account of its supposed resemblance to the root of the wild vine. The Germans call it *Grieswurzel* (i. e. gravel root), on account of its beneficial effects in stone or gravel.

BOTANY. Gen. Char.—Diœcious. *Male*: sepals 4, in a double series. *Petals* 4, united into a cup-shaped corolla, with usually an entire margin. *Stamens* united into slender columns dilated at the apex, bearing two 2-celled anthers opening horizontally; cells placed end to end, and forming a 4-lobed, 4-celled annulus round the top of the column. *Female*: calyx of 1! lateral sepal. *Corolla* of 1! petal in front of the sepal. *Ovary* solitary. *Stigmas* 3. *Drupe* obliquely reniform; but compressed, wrinkled round its margin. *Seed* solitary uncinately; *embryo* long, terete, inclosed in a fleshy albumen. (Wight and Arnott.)

Sp. Char.—*Leaves* peltate, subcordate, ovate-articulate; silky-pubescent beneath. *Female racemes* larger than the leaf. *Berry* hispid. (De Cand.)

A climbing shrub. *Root* woody, branching. *Stem* round, smooth, or with close-pressed down. *Leaves* aristate at the point, when full-grown smooth above, underneath covered with silky pubescence (hence called *velvet leaf*), but not truly downy. *Flowers* small, yellow. *Berry* scarlet, round or reniform, hispid.

Hab.—West India Islands and Spanish Main.

DESCRIPTION.—The root of *Cissampelos Pareira*, commonly termed *pareira brava* (*radix pareiræ bravæ*), is sometimes imported under the name of *abuta* or *butua root* (*radix butæ*). Von Martius says that, in the Brazils, *Cissampelos Pareira* is called *Butua* or *Caupêba*. *Pareira* brava occurs in more or less cylindrical pieces, sometimes flattened or bluntly angular. Some of the pieces are as thick as a child's arm—their length often a foot or more. Externally, they are covered with a dark-brown rind or cortex, which is furrowed longitudinally, and wrinkled transversely. The wrinkles have very much the appearance of large, transversely elongated lenticellæ. The surface of the transverse section of the root is of a yellowish-gray colour, and presents a number of concentric circles (the annular layers), traversed by numerous radiating lines (medullary rays); between these lines are triangular bundles of woody fibres and ducts—the latter are large, and being cut transversely,

¹ Rust's Mag. Bd. xiv. St. i. S. 105.

² Murray, App. Med. i. 499.

³ Hist. Nat. Brasil. 94.

constitute the numerous holes or apertures presented by the cut surface. The circles or layers occasionally assume a very eccentric appearance.

The number of concentric circles varies with the age of the root. The fracture of the root is coarsely fibrous. The taste is sweetish, aromatic, afterwards bitter and unpleasant. It has no odour.

SUBSTITUTION.—The pareira brava of commerce yields most unequal quantities of extract. This circumstance, as well as some variation in the appearance of the pieces, leads to the belief that the roots (and stems?) of more than one plant, are sold under this name. A sample of a supposed spurious root,¹ yields “only a very minute quantity of the extract; and the decoction prepared from it, according to the usual formula, has only a slightly bitter taste, instead of the strong bitter of the decoctions” of the true root. A piece of this supposed spurious root presents an appearance of medulla, and is covered externally with a lichen; whence it would appear to be a portion of a stem.

COMPOSITION.—Pareira brava has been analyzed by Feneulle,² who found the constituents to be, a soft resin, a yellow bitter principle, a brown colouring principle, *vegeto-animal matter, fecula, super-malate of lime, nitrate of potash*, and some *ammoniacal and mineral salts*. More recently, Wiggers³ has announced the discovery of a new vegetable alkali, which he calls *cissampelin*, in this root.

1. Feneulle considers the **YELLOW BITTER MATTER** to be the active principle of the root. It is described as being soluble in both alcohol and water. From its solution it was precipitated by tincture of nutgalls as well as by diacetate of lead. In these properties it appears to agree with cathartine; but it is, probably, a mixture of several substances.

2. The properties of **CISSAMPELIN** have not been described. Wiggers says it is a strong, saline base, soluble in ether and in acetic acid. From its acetic solution it is precipitated by carbonate of soda.

CHEMICAL CHARACTERISTICS.—The presence of starch in the root is shown by iodine. An infusion of the root yields a precipitate on the addition of infusion of galls, and is rendered brown by the sesquichloride of iron.

PHYSIOLOGICAL EFFECTS.—I am unacquainted with any experiments made to determine the effects of this root in the healthy state of the body. From its taste, botanical affinities, and effects in diseases, it appears to possess a tonic power, and occasionally to act as a diuretic. Furthermore, its efficacy in certain maladies of the urinary organs induces us to ascribe an almost specific influence to this root over the mucous membrane lining the urinary passages. It certainly does appear to have the power of altering the quality of the urinary secretion. Large doses prove aperient.

USES.—It was originally introduced into medicine as a lithontriptic. Its powers in this way were at one time highly vaunted, and Helvetius even went so far as to assert that calculi, the size of an olive, had disappeared under its use, and that the operation of lithotomy was no longer necessary! We now employ it almost solely in discharges from the *urino-genital mucous membrane*.—It has been used in gonorrhœa, leucorrhœa, and chronic inflammation of the bladder. In the latter of these diseases, Sir. B. Brodie⁴ states that he has seen more good done by this root than by the Uva-ursi. “I am satisfied,” says this eminent surgeon, “that it has a great influence over the disease which is now under consideration, lessening very materially the secretion of the ropy mucus, which is itself a very great evil, and, I believe, diminishing the inflammation and irritability of the bladder also.” He recommends it to be taken in the form of a concentrated decoction, to which may be added some tincture of hyoscyamus; and in these cases in which there is a deposit of the triple phosphates, muriatic or diluted nitric acid may be added.

ADMINISTRATION.—The powder has been given in doses of from half a drachm to a drachm. But the *infusion or decoction*, to which some *extract* has been added, is to be preferred. A *tincture or essence* has been prepared by digesting one part of

¹ See *Lond. Med. Gaz.* vol. xviii. p. 962; and vol. xix. p. 835.

² *Berl. Jahrb.* xl. 223, 1835.

³ *Journ. de Pharm.* vij. 404.

⁴ *Lond. Med. Gaz.* i. 300.

the root in five parts of rectified spirit. It is reputed diuretic and anticatarrhal. Its dose is fʒj.

1. DECOCTUM PAREIRÆ, L.; *Decoction of Pareira*.—(Pareira, sliced, ʒx; Distilled Water Oiss. Boil to a pint and strain.) [Narcotics, especially hyoscyamus, and alkalies or acids, may be added to this decoction as occasion may require. A stronger decoction than this is recommended by Sir Benjamin Brodie, who employs ʒss of the root to Oij of water, to be gently boiled down to one pint. Eight to twelve ounces of this should be taken daily. This is certainly a more effective preparation than that of the Ph. L.—ED.]

2. INFUSUM PAREIRÆ, E. D.; *Infusion of Pareira Brava*.—(Pareira ʒvj; Boiling Water Oj. Macerate for two hours in a lightly covered vessel, and strain through calico, E.)—Dose, fʒj to fʒij. It will be advisable to increase the strength of this infusion by the addition of some extract of pareira to it. The Dublin College orders ʒss of the bruised and torn root, to ʒix of boiling water, and macerates for one hour.

3. EXTRACTUM PAREIRÆ, L. E.; *Extract of Pareira Brava*.—(Prepared as Extract of Hæmatoxylon [as Extract of Liquorice-root, E.]—Dose, gr. x. to ʒss. It is usually given in conjunction with the infusion or decoction.

OTHER MEDICINAL MENISPERMACEÆ.

The student must not confound PAREIRA BRAVA with the PAREIRA BARK belonging to *Strychnaceæ*, and before noticed, nor with the PAREIRA MEDICA, Lindley,¹ a menispermaceous plant, whose root is employed by the Cingalese as a stomachic.

ORDER LXXXVII. MAGNOLIACEÆ, *De Candolle*.—THE MAGNOLIA TRIBE.

MAGNOLIACEÆ and WINTERACEÆ, *Lindley*.

CHARACTERS.—All the parts of the flower disposed in ternary number. *Sepals* 3 to 6, deciduous. *Petals* 3 to 27, in many series, hypogynous. *Stamens* numerous, free, inserted on the torus beneath the ovaries; *anthers* adnate, elongated. *Ovaries* numerous, inserted on the torus above the stamens, generally disposed like a spike, monostylous; *styles* short; *stigmas* simple. *Carpels* as many as the ovaries, 1-celled, 1- or many-seeded, capsular, and dehiscing by a superior chink; or capsular bivalved, dehiscing by an inferior chink; or follicular: or somewhat fleshy and indehiscent; or, lastly, samariform, aggregate, or partially united into a loose or dense strobile. *Seeds* attached to the internal angle of the carpels; *albumen* fleshy; *embryo* straight, small, inferior.—Elegant trees or shrubs. *Leaves* alternate, pinnatinerved. *Flowers* conspicuous, often powerfully odoriferous. (De Cand.)

PROPERTIES.—Bark tonic and aromatic. The same properties are possessed by some of the fruits. The flowers by their odour readily occasion nausea, headache, and faintness.

342. DRIMYS WINTERI, *De Candolle*.—WINTER'S BARK TREE.

Wintera aromatica, *Murray*.

Sex. Syst. Polyandria, Tetragynia.

HISTORY.—William Winter, captain of one of the ships which accompanied Sir Francis Drake, in the year 1578, to the Straits of Magellan, returning in 1579, brought the bark of some trees, which he had cut down there, to Europe. From this circumstance Clusius² called it *Winter's bark* (*Winteranus cortex*). It was afterwards confounded with *Canella bark*.

BOTANY. *Gen. Char.*—Carpels congested, baccate, many-seeded. *Filaments* thickest at the apex; cells of the anther separate. (De Cand.)

¹ *Fl. Med.* 370.

² *Exot. lib. iv. cap. i. p. 75.*

Sp. Char.—*Leaves* oblong, obtuse, glaucous beneath. *Peduncles* simple, approximated, or very short, divided into elongated pedicels. (De Cand.)

Fig. 418.

*Drimys Winteri.*

A large forest tree. *Branches* often tuberculated from the scars of the old footstalks. *Sepals* 2 to 3, green. *Petals* 7, milk-white. *Fruit* ovate.¹

Hab.—Straits of Magellan, Chili, Peru, New Grenada.

DESCRIPTION.—Winter's bark (*Cortex Winteri* seu *Winteranus*) occurs in quills or rolled pieces, commonly a foot long, one or two inches in diameter, and two or three lines thick. Its colour externally is pale-yellowish, or dull reddish gray, with red elliptical spots; internally, it is reddish-brown. Its odour is aromatic, its taste warm and pungent. The characters by which it is distinguished from Canella bark have been already pointed out. Its infusion is darkened by the salts of iron.

COMPOSITION.—Winter's bark has been analyzed by M. Henry,² who found its constituents to be *resin, volatile oil, colouring matter, tannin, acetate of potash, chloride of potassium, sulphate of potash, oxalate of lime, and oxide of iron.*

1. **VOLATILE OIL** (*Oleum Corticis Winteri*).—Pale-yellow, lighter than water, with a very hot and acrid taste. By standing it is separated into two parts; one (the most abundant part) a greenish yellow liquid; the other (heavier, but lighter than water) white, and of a fatty consistence.

2. **RESIN.**—Reddish-brown, and almost odourless. Its taste is at first feeble; then acrid and persistent.

PHYSIOLOGICAL EFFECTS AND USES.—Stimulant, aromatic, and tonic. Its uses are similar to those of cinnamon and canella alba. Winter employed it in scurvy. It is seldom employed.—Dose, ʒss or ʒj.

MAGNOLIA GLAUCA, Linn.

(Magnolia, U. S. Sec. List.)

This is usually a small tree, the height of which varies from 10 to 30 feet, branching, with a smooth, glaucous, whitish bark. The *leaves* are from three to five inches long, and an inch and a half to two inches wide, nearly elliptical, rather acute, sometimes obtuse, shining green above, very glaucous beneath, and when young, the under surface clothed with a glaucous, silky pubescence. *Petioles* three-quarters of

Fig. 419.



an inch long. *Flowers* very fragrant, on thick, clavate, pubescent peduncles, about half an inch in length. *Sepals* oblong, concave, roughish, dotted, as long as the petals. *Petals* white, an inch or an inch and a half long, obovate. *Stamens* numerous; *filaments* short, with the point extending above the adnate anthers. *Ovaries* collected in an ovoid cone; *styles* very short, recurved. *Carpels* opening longitudinally. *Seeds* obovate, covered with a purple fleshy arillus, falling out of the carpels when mature,

¹ See Solander's *Med. Obs. and Inq.* vol. v. p. 41.

² *Journ. de Pharm.* t. v. p. 489.

and hanging for some time by a long filiform funiculus. (Darlington, *Flora Cestrica*.) *Sex. Syst. Polyand. Polygyn.*

This plant is abundant along the Atlantic coast, from Massachusetts to Florida, where it frequents thick swamps and morasses; it does not grow spontaneously in dry and argillaceous ground unless transplanted. It is readily detected when in bloom by the rich perfume of its handsome white flowers; this occurs in May and June. The glaucous leaves and white shining bark at other seasons serve to distinguish it from the trees with which it grows. In the Southern States it is called *White Bay* and *Sweet Bay*. The bark is taken off during the spring and summer. When dried, it is in pieces several inches in length, and an inch or two broad, somewhat rolled, light; ashen, smooth and silvery externally, white and fibrous internally. It has an aromatic odour, which is impaired by time, and a taste warm, pungent, and bitterish. The bark of the root has similar sensible properties, and is regarded as being superior to that of the trunk and branches; it is rough externally. No detailed account has been given of its chemical composition; it is probable that an active principle, similar to *Liriodendrine*, found in the *M. grandiflora*, by Mr. Stephen Procter (*Am. Journ. of Pharm.* vol. xiv. p. 95), is also to be found in this species. Magnolia is tonic and diaphoretic in its effects on the animal economy, and may be used in cases where these effects are available. Its employment has been beneficial in the treatment of chronic rheumatism, and has proved serviceable in arresting the paroxysms of intermittent fever. The dose is ʒss to ʒj, in powder; or a decoction may be made in the proportion of ʒj to Oj.—Dose, ʒj or ʒij. An infusion in brandy is sometimes used in rheumatism.

The *M. ACUMINATA*, *Cucumber Tree*, officinal in *U. S. Pharm.*, is a large tree, inhabiting the mountainous districts of the United States; and the *M. TRIPETALA* (*Umbrella Tree*), also officinal, is a much smaller tree. The bark of both affords the officinal drug in common with the preceding. The uses are the same.

The *MAGNOLIA GRANDIFLORA* is deserving of a similar rank. Mr. S. Procter (*op. cit.*) found the bark to contain *green resin*, *volatile oil*, and a peculiar *crystallisable principle* analogous to *Liriodendrine*, an *acid* precipitating the salts of iron green, and *salts*.

LIRIODENDRON TULIPIFERA, Linn.—AMERICAN POPLAR TULIP TREE.

(*Liriodendron*, *U. S. Sec. List.*)

This tree is one of the handsomest peculiar to the United States. Its height varies from 60 to 100 feet, and it is often four or five feet in diameter. In the old trees the branches are spreading at the summit, and frequently of great height without branches; in the young trees the branches are in the form of a cone. *Buds* large, compressed, obovate. *Leaves* three to five inches long, and four to six inches broad, nearly quadrangular in their outline, smooth, shining green above, paler beneath, rounded or subcordate at base, with a short, diverging, acuminate lobe (sometimes two) on each side, and the broad central lobe emarginately truncated. *Petioles* two to three inches long. *Flowers* large, campanulate, each with two caducous bracts at base. *Sepals* obovate-oblong, concave, pale yellowish-green, as long as the petals, spreading, and at length reflexed, deciduous. *Petals* lance-obovate, mostly obtuse, greenish-yellow, stained with reddish-orange below the middle. *Stamens* in a simple series, shorter than the petals; *filaments* with a lance-ovate point extending above the long adnate anthers. *Ovaries* closely imbricated; *stigmas* sessile, recurved. *Carpels* two-celled, samara-like, with a lance-oblong

Fig. 420.



wing at apex, incurved at base, with a prominent internal ridge, imbricated in a cone upon a slender fusiform receptacle; one of the cells frequently obliterated, and both seeds often abortive. (Darlington, *Flor. Cest.*) *Sex. Syst. Polyand. Polygyn.* It is called *Tulip Tree* on account of its numerous large, showy, orange-coloured, tulip-shaped flowers. According to *Michaux*, the northern limit of this tree may be placed at the southern extremity of Lake Champlain, lat. 45°, and it seldom is found east of the Connecticut River. It is found abundantly through the Middle and Southern States, requiring a rich, not too moist, soil.

The bark of the trunk and larger branches is very rough, and covered with dead epidermis, which is very much split and divided; upon the smaller branches it is smooth, and of a deep ashen hue. It is brought into the market in pieces of three or four inches long, deprived of epidermis, and of a yellowish-white colour, light, fibrous, and easily broken; the odour is somewhat aromatic; the taste pungent, aromatic, slightly camphorous, and bitter. The article obtained from the root has similar sensible properties, but browner externally and rougher.

A peculiar principle (*Liriodendrine*) has been obtained from this bark by the late Prof. Emmet, of the University of Virginia (*Journ. of Phil. Col. of Pharm.* vol. iii. p. 5). It is a crystalline solid, bitter and inodorous at 40°, fusible at 180°, and volatile at 290° F. When carefully heated in a glass tube closed at one end, it gives off a white vapour, which condenses again, without signs of crystallization. It is not acid or alkaline. Its discoverer regarded it as a substance analogous to camphor.

The medical properties of *Liriodendron* are those of a stimulant and tonic; in large doses it is diaphoretic, and is also stated to be diuretic. As a febrifuge it has been employed by a number of American physicians; but as it is stimulant, and apt to sicken the stomach, or to act upon the bowels, the condition of the organs is to be strictly inquired into, and the system prepared for its employment. Dr. Young regarded it as also beneficial in hysteria, and as an anthelmintic. The dose in substance is ℥j to ℥ij. In this form it acts with most power. As it yields its virtues to water and alcohol, it may be exhibited either in infusion, decoction, or tincture. There are no official preparations.

OTHER MEDICINAL MAGNOLIACEÆ.

ILlicium anisatum is an evergreen tree, growing in Japan and Cochin-China. Its fruit constitutes the *star-anise* (*anisum stellatum*) of the shops. It consists of a variable number (usually six to twelve) of hard woody foliicles, disposed in a star-like form, each containing an oval reddish seed. It has the odour of common anise (*Pimpinella Anisum*), but somewhat sweeter. By distillation it yields the *oil of star-anise* (*oleum badiani*), which closely resembles, and is often substituted for, the oil of common anise; but it congeals less readily than the latter. Star-anise is aromatic and carminative. Both the fruit and the oil are employed by liqueur-makers. As regards its effects it might be substituted for common anise.

ORDER LXXXVIII. RANUNCULACEÆ, *De Candolle*.—THE CROWFOOT TRIBE.

CHARACTERS.—*Sepals* 3 to 6, hypogynous, deciduous, generally imbricate in æstivation, occasionally valvate or duplicate. *Petals* 3 to 15, hypogynous, in one or more rows, distinct, sometimes deformed. *Stamens* definite or indefinite in number, hypogynous; anthers adnate. *Carpels* numerous, seated on a torus, 1-celled or united into a single many-celled pistil; *ovary* one or more seeded, the *ovules* adhering to the inner edge; *style* 1 to each ovary, short, simple. *Fruit*, either consisting of dry akenia, or baccate with one or more seeds, or follicular with one or more valves. *Seeds* albuminous; when solitary, either erect or pendulous; *embryo* minute; *albumen* corneous—*Herbs*, or very rarely *shrubs*. *Leaves* alternate or opposite, generally much divided, with the petiole dilated and forming a sheath half clasping the stem. *Stipules* occasionally present. *Hairs*, if any, simple. *Inflorescence* variable. (*Lindley*.)

PROPERTIES.—Mostly poisonous. Acridity is the prevailing quality, conjoined, in a considerable number of instances, with a narcotic quality. Several of the species are topical benumbed.

343. RANUNCULUS ACRIS, Linn.—UPRIGHT MEADOW CROWFOOT.

Sex. Syst. Polyandria, Polygynia.

BOTANY. *Gen. Char.*—*Calyx* of 5 sepals; sepals not separate at the base, deciduous. *Petals* 5, rarely 10, with nectariferous scales at the base. *Stamens* and *ovaries* numerous. *Caryopsides* ovate, somewhat compressed, terminating in a short mucro or horn, scarcely larger than the seed, smooth, striated or tuberculated, arranged in a globose or cylindrical head. (De Cand.)

Sp. Char.—*Calyx* spreading. *Flower-stalks* round and even. *Leaves* in three deep-lobed and cut segments; those of the uppermost linear and entire. *Stem* erect, covered with close hairs.¹

Perennial. *Flowers* yellow. *Petals* with a scale at the base.

Hab.—Indigenous; very common in meadows and pastures. *Flowers* in June and July.

COMPOSITION.—Not analyzed. Its *acid principle* is either very volatile, or readily undergoes decomposition, as, by drying, the plant loses its acridity.

PHYSIOLOGICAL EFFECTS.—A powerful acid. Inflammation of the palm of the hand has been produced by pulling it up and carrying it a little distance.² Withering³ says it easily blisters the skin. Orfila⁴ has shown, by experiments on animals, its powers of causing inflammation of the tissues to which it is applied.

USES.—It has been applied as a rubefacient and epispastic, but is far inferior to cantharides and mustard, on account of the uncertainty of its operation.

344. RANUNCULUS FLAMMULA, Linn.—LESSER SPEAR-WORT CROWFOOT.

Sex. Syst. Polyandria, Polygynia.

BOTANY. *Gen. Char.*—See *Ranunculus acris*.

Sp. Char.—*Leaves* ovate-lanceolate, bluntish stalked. *Stem* reclining. *Root* fibrous. *Seeds* smooth. (Smith.)

Perennial. *Leaves* nearly entire, subserrate. *Flowers* bright gold colour.

Hab.—Indigenous; sides of lakes and ditches abundant.

PHYSIOLOGICAL EFFECTS AND USES.—Similar to those of *Ranunculus acris*.

345. HELLEBORUS NIGER, Linn., L. E.—BLACK HELLEBORE, OR CHRISTMAS ROSE.

Sex. Syst. Polyandria, Polygynia.

(Rhizoma et radix, L.—Root, E.)

[Helleborus, U. S.]

HISTORY.—According to Sprengel,⁵ this is the plant called by the Abbess Hildegard, *Christiana*.

It must not be confounded with the *ἐλλέβορος μέλας* (*black hellebore*) of Dioscorides,⁶ which, according to Dr. Sibthorp,⁷ was the plant which he has described and figured under the name of *Helleborus officinalis*. Hippocrates employed hellebore in medicine. Melampus employed it with great success, in the treatment of

¹ Smith, *Eng. Fl.*

² *Arrang. of Brit. Plants*, iii. 681.

³ *Hist. Rei Herb.* i. 226.

⁴ *Fl. Græca*.

⁵ Curtis, *Fl. Lond.* vol. i.

⁶ *Tox. Gén.*

⁷ *Lib.* iv. cap. 151.

madness, 1,400 years before Christ. His use of it is the earliest instance on record of the use of a purgative.¹ It has been called after him *melampodium*—a term which has also been applied to *Helleborus niger*.

BOTANY. Gen. Char.—*Calyx* persistent, of 5 sepals; sepals roundish, obtuse, large, usually green. *Petals* 8 to 10, very short, tubular, narrow, and nectariferous beneath. *Stamens* 30 to 64. *Ovaries* 3 to 10. *Stigmas* terminal, orbicular. *Cap-sules* coriaceous. *Seeds* in a double row, elliptical, umbilicated. (De Cand.)

Sp. Char.—*Leaves* radical, pedatisect, quite smooth. *Scape* leafless, one- to two-flowered, bracteated. (De Cand.)

Rhizome several inches long, tuberculated, horizontal, scaly, blackish-brown externally, white internally, with many dependent, long, simple root-fibres. *Leaves* on cylindrical stalks from 4 to 8 inches long; lobes ovate-lanceolate, serrate near the point. *Scape* shorter than the petiole. *Sepals* ovate or roundish, large, white, slightly tinged with pink, eventually becoming green. *Petals* green, tubular, shorter than the stamens. *Follicles* many-seeded. *Seeds* black, shining.

Hab.—Sub-alpine, woodland regions in the midland and southern parts of Europe.

COMMERCE.—Hellebore root is imported in barrels and bags from Hamburg usually, but sometimes from Marseilles.

DESCRIPTION.—The root met with in commerce under the name of black hellebore root (*radix hellebori nigri*, seu *radix melampodii*) consists of two parts—the rhizome or rootstock, and the fibres which arise from it. The rhizome is half an inch or less thick, several inches long, horizontal or contorted, knotty, with transverse ridges and slight longitudinal striæ. The fibres are numerous, cylindrical, dark brown externally, internally whitish or yellowish-white, with a central paler cord. The odour is very feeble, and scarcely perceptible, but has been compared to that of senega root. Its taste is slight at first, then bitterish, acrid, and nauseous.

SUBSTITUTION.—It is probable that the roots of *Helleborus viridis* and *foetidus* are sometimes substituted for, or intermixed with, black hellebore root. This practice certainly occurs on the continent. The root of *Actæa spicata* (sometimes called *radix hellebori nigri falsi*) is also said to be occasionally substituted for the genuine root; its stronger fibres, when cut transversely, present the form of a cross. As far as I have observed, the roots, sold in this country as black hellebore, have a very uniform appearance, and from this I have not had reason to suspect any intermixture of other roots.

COMPOSITION.—Vauquelin² analyzed the root of *Helleborus hiemalis*. This analysis is quoted by Soubeiran³ as the analysis of black hellebore root. Feneulle and Capron⁴ analyzed the black hellebore root.

Vauquelin's Analysis.

Very acrid oil.
Extractive.
Starch.
Vegeto-animal matter.
Sugar.
Lignin.

Root of *Helleborus hiemalis*.

Feneulle and Capron's Analysis.

Volatile oil.
Fatty oil.
Volatile acid.
Resinous matter.
Wax.
Bitter principle.
Ulinin.
Gallate of potash.
Ammoniacal salts.

Root of *Helleborus niger*.

ACRID OIL, Vauquelin; *Soft Resin*, Gmelin; *Helleborin*.—This substance is odourless, has an acrid taste, and is soluble in spirit. Vauquelin ascribed the activity of hellebore to it. Feneulle and Capron, on the other hand, ascribe it to a combination of *fatty oil* and *volatile acid*. Probably the two latter correspond to the acrid oil of Vauquelin.

PHYSIOLOGICAL EFFECTS. a. On Animals.—Given by the mouth to the car-

¹ Le Clerc, *Hist. de la Méd.* p. 27, 1729.

³ *Nouv. Traité de Pharm.* i.

² *Ann. de Muséum*, viii. 87.

⁴ *Journ. de Pharm.* viii. 503.

nivora (as dogs), it causes vomiting, frequently purging and griping. In excessive doses it produces gastro-enteritis. If the œsophagus be tied, to prevent the ejection of the root from the stomach, it causes staggering, weakness or paralysis of the hind extremities, insensibility, and death. Similar effects result from its application to a wound.¹ Orfila states, when the animals survive a few hours, inflammation of the rectum is a constant occurrence; whereas, Vicat² says it causes inflammation of all the intestines, except only the rectum. The latter statement is entirely erroneous.

β. *On Man.*—Black hellebore is a local irritant, drastic purgative, and emmenagogue. Given in *small doses*, it increases the secretion and peristaltic motion of the intestines, and acts as a stimulant to the pelvic circulation, thereby promoting the menstrual and hemorrhoidal discharges, and, by its influence over the portal circulation, contributing probably to increase the hepatic secretion. *Large doses* act as a drastic purgative, and frequently also occasion sickness. They produce a more manifest influence over the pelvic vessels, often cause cold sweats, and lower the strength of the pulse. In an *excessive or poisonous dose* it acts as a narcotico-acrid poison, and causes vomiting, purging, burning pain in the stomach and intestines, cramps of the lower extremities, cold sweats, faintness, paralysis, insensibility, and death. The fresh root *applied to the skin* produces rubefaction and vesication.

As a drastic purgative it is allied to colocynth, from which its narcotic operation and its greater influence over the pelvic organs distinguish it.

USES.—Black hellebore, though greatly esteemed by the ancients, is but little employed by the moderns. It is adapted for torpid, phlegmatic individuals, especially when the pelvic circulation is languid. On the other hand, in easily excitable persons, and where any irritation of the pelvic organs (especially the uterus and rectum) exists, it proves injurious.

1. *In affections of the nervous system*, especially mania, melancholia, and epilepsy, it has long been celebrated, and, under the above-mentioned conditions, at times proves serviceable.

2. *As an emmenagogue*, it was greatly esteemed by Dr. Mead,³ and is still much valued by some practitioners. He gave two teaspoonfuls of the tincture in a glass of warm water twice a day. The remarks already made will readily suggest the class of cases to which it is applicable.

3. *In dropsy*, its drastic operation renders it useful. Furthermore, when this disease depends on, or is connected with, a languid state of the portal circulation, black hellebore proves farther useful by the stimulus which it communicates to the hepatic vessels.

4. Lastly, black hellebore has been used in *chronic skin diseases*, and as an *anthelmintic*.

ADMINISTRATION.—The dose of powdered hellebore is from grs. x to ℥j, as a drastic purgative. When we require a milder effect, we may give it in doses of grs. iij to grs. viij. It has also been given in decoction; but the tincture is the most frequently employed preparation.

TINCTURA HELLEBORI, L. [U. S.]; *Tincture of Black Hellebore*.—(Hellebore, bruised, ℥v. [℥iv, U. S.]; Proof Spirit [Diluted Alcohol, U. S.] Oij. Macerate for seven days, and strain.)—Dose, fʒss to fʒj. Principally employed as an emmenagogue.

¹ Orfila, *Toxicol. Gén.*; Schabel, quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. 11.

² *Hist. des Plant. Vén. de la Suisse*, p. 69.

³ *Works*, p. 563, 1762.

346. DELPHINIUM STAPHYSAGRIA, Linn. L. E.— STAVESACRE.

Sex. Syst. Polyandria, Trigynia.
(Semina, L.—Seeds, E.)

HISTORY.—Hippocrates employed stavesacre in medicine. Sibthorp¹ found the plant growing in Crete and Zante, and identified it with the *σταφίς ἀγρία* of Dioscorides.²

BOTANY. *Gen. Char.*—*Calyx* deciduous, petaloid, irregular; the *sepals* elongated at the base into a spur. *Petals* 4, the two upper appendiculated within the spur. (De Cand.)

Sp. Char.—*Spur* very short. *Bractlets* inserted at the base of the pedicel. *Petioles* pilose. *Pedicels* twice as long as the flower. (De Cand.)

A stout herb, one or two feet high. *Stem* and *petioles* hispid, with soft hairs. *Leaves* broad, palmated, stalked, 5 to 9-cleft. *Racemes* lax. *Flowers* bluish or purplish. *Capsules* 3, large.

Hab.—South of Europe, the Levant, and the Canaries.

DESCRIPTION.—Stavesacre seeds (*semina staphisagriæ* seu *staphidis agriæ*) are irregularly triangular (sometimes quadrangular), slightly arched, blackish-brown, and wrinkled. They contain a white and oily nucleus. Their odour is slight but disagreeable; their taste bitter, very acrid, hot, and nauseous. Iodine colours the seeds brown. Their watery infusion is darkened by sesquichloride of iron. Infusion of nutgalls renders it turbid.

COMPOSITION.—Stavesacre seeds were analyzed in 1820 by Brandes,³ and in 1821 by Lassaigue and Feneulle.⁴

Brandes's Analysis.		Lassaigue and Feneulle's Analysis.	
Delphinia	8.10	Malate of delphinia.	
Fatty oil	19.10	Volatile oil.	
Waxy substance	1.40	Fatty oil.	
Gum	3.15	Brown bitter matter.	
Starch	2.40	Yellow ditto.	
Woody fibre	17.20	Uncrystallizable sugar.	
Phytocol with salts	30.67	Gum.	
Vegetable albumen	3.70	Woody fibre.	
Sulphates and phosphates of lime, potash, and magnesia	5.77	Animal matter.	
Water	10.00	Albumen.	
		Mineral salts.	
Stavesacre Seeds	100.49	Stavesacre Seeds.	

1. **DELPHINIA** (*Delphina*; *Delphine*; *Delphinum*).—As usually met with, this is a white odourless powder. Its taste is extremely acrid and very bitter. It fuses at 248° F. It is scarcely soluble in water whether hot or cold, but dissolves in ether, and still better in alcohol. Its alcoholic solution reacts as an alkali on test paper. It is not crystallizable, though its texture is said to be crystalline, when the powder is moistened. It saturates acids, forms salts which are acrid, very bitter, and difficultly crystallizable. From its solution in acids, it is precipitated by alkalis. Its composition is $C^{27}H^{19}NO^2$. Its atomic weight, therefore, is 211. Couerbe⁵ says that, as usually procured, it is not absolutely pure, but contains a resinous matter, and an acrid resin which he calls *staphysain*.

2. **VOLATILE ACID** (*Delphinic Acid?*)—Discovered by Hofschlger.⁶ It is white, crystalline, volatile at a low temperature, and in small doses is a powerful emetic.

PHYSIOLOGICAL EFFECTS.—The activity of stavesacre seeds depends partly on the delphinia and partly on the volatile acid. The powder of the seeds readily excites nausea, vomiting, and purging. Orfila⁷ has shown that on dogs it acts first as an acrid and afterwards as a narcotic poison. Its operation appears to be similar to cecadilla.

USES.—Stavesacre seeds have been used to destroy pediculi; whence the Germans

¹ *Prodr. Fl. Græc.* i. 372.

² Gmelin, *Handb. d. Chem.* ii. 1240.

³ *Journ. de Pharm.* xiii. 365.

⁴ *Toxicol. Gen.*

⁵ *Lib. iv. cap. 156.*

⁶ *Ann. de Chim. et. de Phys.* xii. 359.

⁷ *Ann. Chim. et de Phys.* l. 2.

term them *Liusesaamen*, or *louse-seeds*. For this purpose they are employed in the form of ointment or acetous infusion. They have also been administered internally (in doses of from three to eight grains) against worms, and externally in the form of decoction (prepared by boiling 3j of the seeds in Oij of water) in inveterate itch.

ANTIDOTE.—See *Veratrum album*.

DELPHINIA.—Four grains of delphinia dissolved in a drachm of rectified spirit produce, when rubbed on the skin, a sensation of burning and prickling, with tingling and slight redness. Taken internally, in doses of half a grain, it sometimes acts slightly on the bowels, and increases the flow of urine. In larger doses, as a few grains, it gives rise to sensations of heat and tingling in various parts of the body.¹ The diseases in which it is chiefly successful are neuralgic cases. It has also been used in rheumatic affections with some benefit. It is employed externally in the form of ointment or alcoholic solution. The *unguentum delphinix* consists of 3ss of delphinia, 3j of olive oil, and 3j of lard. The *schutio delphinix*, composed of ʒj of delphinia dissolved in f3ij of rectified spirit, is an excellent embrocation. Internally, delphinia is given in the form of pills. The *pilulæ delphinix* consists of gr. j of delphinia; grs. xij extract of hyoseyamus; and the same quantity of extract of liquorice. Divide the mass into twelve pills, one of which may be taken every three hours (Turnbull).

347. ACONITUM NAPELLUS, Linn., L. E. D.—COMMON WOLFSBANE, OR MONKSHOOD.

Sez. Syst. Polyandria, Trigynia.

(Folium recens et exsiccatum; Radix, L.—Leaves, E.—The Root, D.)

HISTORY.—The ancient history of Aconite is involved in great obscurity. The Greeks make frequent reference to a most virulent poison which they term *ἀκόνιτον*. Theophrastus² is the earliest writer who speaks of it. As *Aconitum Napellus* is a virulent poison, and is a native of Greece, where it is known at the present day as *ἀκόνιτον*,³ it would at first appear probable that our common aconite was the plant referred to by the ancient Greeks. But the characters of it as given by Theophrastus quite preclude this supposition; and I believe no one has been able to identify satisfactorily the plant described by this ancient naturalist.⁴ Dioscorides⁵ has noticed two kinds of *ἀκόνιτον*.

BOTANY. Gen. Char.—*Calyx* petaloid, irregular, deciduous, or withering; upper sepal concave, helmet-shaped. *Petals* 2, superior (nectaries), on long stalks, expanded at the apex into a bag hidden beneath the helmet. (De Cand.)

Sp. Char.—*Flowers* densely spiked or loosely paniced. *Helmet* semicircular, rarely boat-shaped. Bag of the *petals* somewhat conical. *Spur* short, thick, inclined. Whigs of the *stamens* cuspidate or evanescent. Lobes of the *leaves* cuneate pinnatisect. *Ovaries* 3, rarely 5, smooth or pilose. (De Cand.)

Perennial herb. *Root* tapering. *Stem* simple. *Flowers* blue.—This species is subject to great variation in the dense or loose condition of the inflorescence, in the form of the helmet, the colour and size of the flower, the breadth and the number of slashes of the leaves, the downiness of the parts of the plant, and the condition of the stem. De Candolle⁶ admits no less than twenty-nine varieties.

Hab.—Europe. It is placed among indigenous plants, but it is a doubtful native.

The *Dublin College* directs the root to be used.

The *London College* directs the root (*radix*) as well as the leaves (*folia*) to be employed.

The *Aconitum Napellus* is one of the most active species of the genus, and no good evidence

¹ Turnbull, *Treat. on Painful and Nerv. Diseases*, p. 78, 1837.

² *Prod. Pl. Græcæ*, i. 372.

³ *Lib. iv. cap. 77 and 79.*

⁴ Consult J. E. F. Schultze, *Toxicol. Vet.* p. xiii. 1788.

⁵ *Hist. Plant.* ix. 16.

⁶ *Prodr.* i. 62.

has yet been adduced to prove its inferiority to the *A. paniculatum* var. γ *Storkianum*, which Stork published as *A. Napellus officinalis*, and which was formerly adopted as the official plant.

Moreover, the roots of *A. paniculatum* are not found in commerce, nor is the plant grown (except in botanical gardens) in this country; so that druggists and apothecaries could not if they would have obeyed the former directions of the London and Dublin Colleges.

DESCRIPTION.—Aconite root (*radix aconiti*), when fresh, consists of a tapering rootstock, placed perpendicularly, or nearly so, in the earth, and of numerous cylindrical fleshy fibres arising from it. At its upper and thickest part the rootstock seldom exceeds the thickness of the finger; inferiorly it is attenuated and filiform. Sometimes two or three rootstocks are conjoined. In the latter case the root has a palmated appearance. Its total length is three or four or more inches. Its colour, as well as that of the fibres, is externally coffee-brown; its odour is earthy. Internally, it is white and fleshy. Its taste is bitter; but after a few minutes a remarkable numbness and tingling is perceived on the lips, tongue, and fauces. By drying, the root shrivels, and becomes darker coloured. The root should be gathered in the spring, just before the leaves appear. The leaves (*folia aconiti*), when chewed, have the same taste, and produce the same feeling of numbness.

COMPOSITION.—No complete analysis either of the root or the leaves of *Aconitum Napellus* has been made. The following are the constituents of the root of *A. Lycotonum*, according to Pallas:¹ a black oil, a green fatty matter, a substance having some analogy with the vegetable alkalies [impure aconitina?], vegetable albumen, starch, lignin, and some salts.

The leaves of *Aconitum medium Schraderi* were analyzed by Bucholz.²

Both Brandes and Peschier announced the existence of a peculiar alkali (*aconitina*) in aconite. Their statement was confirmed, in 1825, by Pallas,³ and, in 1832, by Geiger and Hesse.⁴ Peschier also asserted that aconite contained a peculiar acid (*aconitic acid*). His assertion has been substantiated by L. A. Buchner, Jr.⁵ It has been since ascertained that the same acid is developed by the action of heat on citric acid. Most chemists have admitted the existence of a volatile acrid principle in aconite, but it has not hitherto been isolated.

1. **ACONITINA.**—See *post*.

2. **VOLATILE ACRID PRINCIPLE.**—This principle, though admitted by several chemists, has not been isolated. Geiger⁶ submitted the fresh herb of *Aconitum Napellus*, with water, to distillation, and obtained a liquor having an acrid taste, an unpleasant odour, and whose emanations affected the eyes. May not this volatile principle be the product of the decomposition of aconitina? The following circumstances favour this suggestion: 1st. The fresh herb and root have little odour: 2d. The local effect of aconitina is similar to that of the root and leaves; 3d. Aconitina, when mixed with the other constituents of the plant, readily undergoes decomposition, so that considerable nicety of manipulation is required in the extraction of it; and Mr. Morson tells me he has sometimes failed to obtain it.

3. **ACONITIC ACID.**—In the evaporation of the juice of aconite, octahedral crystals of *aconitate of lime* are frequently deposited. From these L. A. Buchner obtained the acid. The acid also exists in *Equisetum fluviatile*, and may be formed by the action of heat on citric acid. As obtained from aconite it is scarcely crystalline, merely forming warty elevations. It is white, permanent in the air, odourless, very sour, and is very soluble in water, alcohol, and ether. When heated it fuses, and at the same time undergoes decomposition; but does not yield fumaric acid. From the latter acid it is distinguished by its greater fusibility and solubility; from maleic acid by its forming indistinct crystals, and not yielding fumaric acid by heat. The anhydrous acid, as found in aconitate of silver, consists of $C^4H^3O^3$.

4. **FATTY OIL.**—This is extracted from the root by alcohol. It is dark coloured. All the specimens of it, which I have obtained, possess a powerfully benumbing property [from the presence of aconitina?].

PHYSIOLOGICAL EFFECTS.—Hitherto, I have met with no clear and accurate account of the effects of aconite, and some of them appear to me to have been entirely overlooked.

a. *On Animals.*—If a small quantity of the soft, alcoholic extract of the root of aconite be introduced into a wound (as into the cavity of the peritoneum) in a dog,

¹ *Journ. de Chim. Méd.* i. 192.

² *Op. supra cit.*

³ *Pharm. Central-Blatt für 1828*, S. 439.

⁴ *Gmelin. Handb. d. Chem.* ii. 1241.

⁵ *Journ. de Chim. Méd.* x. 464.

⁶ *Ibid.* 1831, 491.

it usually causes vomiting (sometimes of a stercoraceous character), diminishes the force of the circulation, weakens the muscular system so as sometimes to cause the animal to stagger in walking, and destroys common sensibility of feeling, without causing stupor. A dog under the influence of not too strong a dose, will sometimes follow its owner round the room, recognize him by wagging his tail when called, and yet be totally insensible to pinching, pricking with needles, &c. Convulsions do not usually occur until a short period before death, and they are then commonly slight, and rather to be termed spasmodic movements. I have repeatedly demonstrated these effects to the pupils attending my lectures.

The following is a notice of one experiment :—

March 31, 1837. London Hospital. Present, Mr. Adams, and several medical students.—A small portion of alcoholic extract of aconite was introduced into the peritoneal sac of a strong dog, which had been kept fasting for some hours. In a few minutes he was evidently affected. He was less capable of supporting himself, and leaned against a wall. In ten minutes was insensible to the pain caused by the introduction of pins into his legs, paws, body, tail, nose, &c. His sight, however, was unaffected; at least, he winked as usual, when attempts to strike him were feigned. Was not paralytic, for he walked, though not firmly. He recognized several individuals, and wagged his tail when spoken to. He made violent attempts to vomit. He then lay down, became apparently weaker, and died without a single convulsion. At one period, the action of the heart was slower than usual, and the first and second sounds of the heart were unusually clear and distinct. Subsequently, the circulation was quickened. Respiration was not disordered; nor were the bowels affected.

I have subsequently found that, if a large quantity of alcoholic extract be used, the loss of feeling is not so well marked; for death succeeds in so short a period of time that the loss of feeling, as distinguished by the insensibility immediately preceding death, is not well observed. For the same reason, rabbits do not answer well for demonstrating these effects; and the weakness (paralysis?) of the hind extremities, and spasmodic movements, are much more marked in them than in dogs. I can distinguish no difference between the effects of *Aconitum Napellus* on rabbits, and those of *Aconitum ferox* on the same animals.¹ On opening the bodies of dogs killed by aconite immediately after death, no pulsations of the heart are visible.—Want of space compels me to abstain from entering into any details respecting the experiments made on animals with aconite by Wepfer,² Sprögel,³ Viborg,⁴ Brodie,⁵ and Orfila.⁶

β. *On Man.*—The topical effects are peculiar, and most remarkable. If a leaf or a small portion of the root be chewed, or a few drops of the alcoholic tincture of the root be applied to the lips, there are produced in a few minutes numbness and a remarkable tingling sensation. These effects endure for many hours. If the quantity taken into the mouth be somewhat larger, the palate and throat are affected. To me, the sensation appears as if the velum and soft palate were elongated, and rested on the dorsum of the tongue. To relieve this, frequent attempts are made to swallow.

When small and repeated doses of the alcoholic tincture of the root are taken internally, they cause a sensation of heat and tingling in the extremities, and occasionally a slight diuresis.

The extract of aconite of the shops is but little to be relied on. Many samples produce neither numbness nor tingling when rubbed on the lips and gums. Störck⁷ states that it acts as a diaphoretic and diuretic. These symptoms, however, are by no means constantly produced, and, when they occur, are not always clearly referable to the aconite used.

In poisonous doses, the effects of aconite are most remarkable. The following details of the effects produced on a family of three persons were furnished me, a

¹ See the results of my experiments on the latter plant, in the splendid work of my friend Dr. Wallich, *Plantae Rariores Asiaticae*; also, a detail of my experiments in the *Edinb. Journ. of Nat. and Geogr. Science*, July 1830, p. 235.

² *Hist. Céc. Aq.* 1733.

³ *Ibid.* S. 34.

⁴ *Toxicol. Gén.*

⁵ *Essay on the Internal Use of the Thorn-Apple, Henbane, and Monkshood*, Lond. 1763.

⁶ Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. i. S. 33.

⁷ *Phil. Trans.* for 1811, p. 178.

few days after the accident, by one of the sufferers (Mrs. Prescott), and her account was confirmed by a very intelligent neighbour who witnessed the progress of the symptoms:—

In December, 1836, Mr. Prescott, aged 57, residing in the City Road, planted in his garden a few pieces of horseradish. On February 5, 1837, he observed some green shoots, which he supposed to be those of horseradish. He dug up three of them. The roots (samples of which were given, and have yielded me thriving plants of *Aconitum Napellus*) were tap-shaped and small. Perhaps a very small walnut would exceed in bulk that of the whole root. These roots were washed, scraped, placed on a plate with some vinegar, and eaten at dinner (at 2 o'clock), with roast beef, by Prescott, his wife (aged 57), and a child (aged 5). It was remarked at dinner that the root was very mild, and had not the pungency of horseradish. After the family had dined, about one root was left; so that two had been eaten at dinner, the greater part (perhaps one or one and a half roots) by the husband. About three-quarters of an hour after dinner, Mr. Prescott complained of burning and numbness of the lips, mouth, and throat, and which soon extended to the stomach, and was accompanied with vomiting. The matters ejected were first his dinner, and afterwards a frothy mucus; but at no time was any blood brought up. The vomiting was very violent and constant for an hour, and continued more or less until within half an hour of his death. An emetic was swallowed at a quarter past 4 o'clock; and, therefore, the subsequent vomiting may be ascribed, in part at least, to this. His extremities were cold, but his chest was warm; the head was bathed in a cold sweat. His eyes, to use the expression of his neighbour, were "glaring." He complained of violent pain in the head, and trembled excessively. The last symptom might, perhaps, be in part owing to his terror of the mistake he had committed. The lips were blue. His mental faculties were not disordered; on this point I made particular inquiry, and I was assured that he was neither delirious nor sleepy, but was quite conscious until within two minutes of his death. He had no cramp, spasm, or convulsion; the only approach to it was trembling. He frequently put his hand to his throat. Though exceedingly weak, he did not lose his power over the voluntary muscles; for, within a few minutes of his death, he was able, with the assistance of his neighbour, to walk to the water-closet. His bowels were acted on once only after dinner, and that on the occasion just mentioned, which was about an hour after he had taken the emetic and some castor-oil. His breathing was apparently unaffected. On his return from the water-closet he was put to bed, and within a few minutes expired, apparently in a fainting state. Death occurred about four hours after dinner.

Mrs. Prescott was affected in a similar way. She had the same burning and numbness of the lips, mouth, throat, and stomach, and violent vomiting. She experienced a curious sensation of numbness in the hands, arms, and legs; and she lost the power of articulating, so that she was unable to tell the address of her son. Her attempts to speak were attended with unintelligible sounds only. She experienced great muscular debility, and was unable to stand. In this respect her condition differed from that of her husband, who could both stand and walk. She felt stiffness of, and difficulty in moving, her limbs. She had no cramps, spasms, or convulsions. The only approach thereto was the stiffness of the muscles when she attempted to put them in action, as in her attempts to wipe her face. Some of the external senses were disordered; thus, to use her own expression, though her eyes were wide open, her sight was very dim, and surrounding objects were seen indistinctly. The hearing was unaffected. The sensibility of the body was greatly impaired; her face and throat were almost insensible to touch. She felt very giddy, but was neither delirious nor sleepy. For the most part she was conscious, but at times scarcely knew what was passing around her. Her body and extremities were cold. She was frequently pulling her throat about, but she knew not why. Five or six hours after dinner she began to recover, and her natural warmth returned. The remedies employed were an emetic, castor-oil, pediluvia, rum and water, and some "warm" medicine given her by a neighbouring practitioner. The child was similarly but more slightly affected, except that she evinced a slight tendency to sleep. Like the others, she was constantly putting her hands to her throat.¹

Mr. Sherwen² has published a most interesting case of a female poisoned by the alcoholic tincture of the root. About five minutes after swallowing it, she was seized with a pricking and tingling down her arms and fingers, and a painful numbness across the wrists; the tongue and mouth next felt the same, then the legs and feet; and in less than ten minutes her face seemed to her feelings to be swelling, and the throat growing tight. She felt sick, and made many efforts to vomit. Her legs failed, she was almost blind, but was conscious of her plight.

¹ [In *The Times* of Nov. 4, 1812, is a brief report of another case of poisoning by aconite root taken by mistake for horseradish. The patient was sensible, but died. Dr. Geoghegan has published some valuable remarks, on this kind of poisoning, in the *Dublin Journal of Medical Science*, vol. xix. page 403.—Ed.]

² *Lancet*, March 25, 1837, p. 13.

When seen by Mr. Sherwen, her eyes were fixed and protruded, with *contracted* pupils; countenance livid; jaws and fauces rigid; arms and hands quite cold and pulseless; the legs and trunk much in the same state; breathing short, imperfect, and laborious; while the heart fluttered feebly. She was sufficiently sensible to tell how the accident occurred. In an attempt to administer an emetic a strong convulsion occurred. Copious vomiting afterwards took place. Five hours after she had taken the poison the pulse was becoming full, only 58 per minute, and intermitting. There was less oppression at the præcordia, and the pupils were larger. She eventually recovered. These cases agree with the one detailed in the *Philosophical Transactions*.¹ Pallas (quoted by Christison) and Degland² have published cases in which violent vomiting, purging, colic, and abdominal tenderness, are said to have been produced by aconite [?].

In comparing the operation of aconite with that of other cerebro-spinants, we observe that its most characteristic topical effect is *numbness and tingling*. Applied to the eye it causes *contraction of the pupil*. When the root or its tincture is swallowed, the most marked symptoms are *numbness and tingling of the parts about the mouth and throat, and of the extremities, vomiting, contracted pupil, and failure of the circulation*. The heart appears to be weakened or paralyzed, and a state approaching to asphyxia is produced. *Convulsion or spasm* is not constantly present, and, when it does take place, is probably a secondary effect arising from the incipient asphyxia. In neither of the cases which I have above detailed, nor in that of Mr. Sherwen, did *stupor* occur. Yet in some recorded instances it has happened. In such it probably depends, as Mr. Sherwen suggests, on the congested condition of the venous system of the brain brought on by the failure of the heart's action, and the consequent accumulation of blood on the right side of the heart.

USES.—A knowledge of the physiological effects of aconite suggests the therapeutical uses of this medicine. A benumber is obviously the physiological remedy for increased sensibility (pain) of the nerves. As a *topical remedy*, aconite is most valuable for the relief of neuralgic and rheumatic pains. In *neuralgia*, no remedy, I believe, will be found equal to it. One application of the tincture produces some amelioration, and, after a few times' use, it frequently happens that the patient is cured. In some cases the benefit seems almost magical. In others, however, the remedy entirely fails to give any permanent relief. Though the pathology of this disease be but little understood, yet we know that the causes of it, and the conditions under which it occurs, are by no means uniform. We are, therefore, easily prepared to believe that while in some cases aconite may prove beneficial, in others it may be useless. I do not think that in any it proves injurious. The causes of neuralgia are, however, usually obscure, and therefore we are in most cases not able to determine *à priori* the probability or the reverse of the beneficial agency of aconite. Hence its employment must be, for the most part, empirical. I have observed that, when it succeeds, it gives more or less relief at the first application. When the disease depends on inflammation, aconite will be found, I think, an unavailing remedy. In a painful affection of the nerves of the face, arising from inflammation of the socket of a tooth, it gave no relief. In *rheumatic pains*, unaccompanied with local swelling or redness, aconite is frequently of great service. In painful conditions of the intercostal and other respiratory muscles, occurring in rheumatic individuals, I have found this remedy most valuable. In one case of *sciatica* it gave partial relief; but in most cases in which I have tried it, it has failed. In *lumbago*, I have not tried it. Dr. Turnbull³ states that a lady was cured of this disease by the aconite ointment. In *acute rheumatism*, its application has not proved successful in my hands; but I have been informed of cases occurring to others in which it has been of great service.

¹ Vol. xxxviii. p. 287.

² See his *Treat. on Painf. and Nerv. Dis.* 1337.

³ *Journ. de Chim. Méd.* iii. 314.

Aconite has been administered *internally* in various diseases, principally on the recommendation of Störck.¹ It has been employed as a narcotic (anodyne) sedative, sudorific, resolvent, and diuretic. The diseases in which it has been employed are *rheumatism, gout, scrofula, phthisis, syphilis, some skin diseases, scirrhus and cancer, intermittents, dropsies, paralysis, epilepsy, amaurosis, uterine affections, and hypertrophy of the heart*. In the large majority of these maladies scarcely any practitioner now believes in its efficacy. Fouquier gave it very extensive trials without obtaining much relief from it, except as a diuretic in *passive dropsies*. In *rheumatism*, it has frequently proved serviceable when combined with a sudorific regimen. I have seen it give great relief in rheumatic pains. In *hypertrophy of the heart* it has been recommended by Dr. Lombard,² on account of its decidedly sedative effects.

ADMINISTRATION.—The only preparations of aconite, whose activity may be relied on, are the *tincture* of the root (made with rectified spirit), the *alcoholic extract*, and Morson's *aconitina*. The *powder* is given in doses of one or two grains, gradually increased, until some effects are produced; but no reliance can be placed on it. When of good quality, it causes numbness and tingling of the lips and tongue a few minutes after its application to these parts.

ANTIDOTES.—See the treatment for poisoning by tobacco. In Mr. Sherwen's case³ great benefit was obtained by the abstraction of ten ounces of blood from the jugular vein.

I. TINCTURA ACONITI, L.; Tinctura Radicis Aconiti, D. [*Tinctura Aconiti Radicis, U. S.*]; *Tincture of Monkshood* [*Tincture of Aconite Root, U. S.*].—(Root of Aconite, recently dried and coarsely powdered, ℥xv ; Rectified Spirit Oij. Macerate for seven days and strain.)—This formula is very nearly that given by Dr. Turnbull.⁴ Its dose is five drops three times a day. It should be employed with great caution. As an embrocation in neuralgia and rheumatism it is invaluable. It is applied by means of a sponge tooth-brush, or a small piece of sponge attached to the end of a stick. Mr. Curtis, of Camden Town, has suggested to me the use of an aconite plaster, prepared by spreading the soft alcoholic extract (obtained by evaporating the tincture) on adhesive plaster, in neuralgia.—[The *Dublin College* gives the following formula for the tincture: Take of Aconite Root, dried and cut small, ℥x ; Rectified Spirit Oj. Macerate for fourteen days, strain, express, and filter.

The following are the directions of the *U. S. Pharm.*: Take of Aconite Root, well bruised, ℔j ; Alcohol Oij. Macerate for fourteen days, express strongly, and filter through paper. This tincture may also be prepared by the process of displacement in the following manner: Take of Aconite Root, in powder, a pound; Alcohol a sufficient quantity. Mix the aconite root with a pint of alcohol, and allow the mixture to stand for twenty-four hours; then transfer it to a percolator, and pour alcohol gradually upon it until two pints of filtered liquor are obtained.]

[*Fleming's Tincture of Aconite* is a more powerful preparation. As this has acquired some repute, and has already occasioned several deaths, we subjoin the formula: Take of Root of Aconitum Napellus, carefully dried and finely powdered, ℥xvj , troy; Rectified Spirit f℥xvj . Macerate for four days, then pack into a percolator; add rectified spirit until twenty-four ounces of tincture are obtained. It is beautifully transparent, of the colour of sherry wine, and the taste is slightly bitter. Dose, as an anodyne and antineuralgic, five minims three times daily. The dose should be cautiously increased.⁵ A revenue officer lately lost his life from merely tasting this tincture, under the supposition that it was wine, or a flavoured spirit.—Ed.]

[Mr. Redfern has communicated to the author a case of poisoning by tincture of

¹ *Essay on the Internal Use of Thorn-Apple and Monkshood*, 1763.

² *Treat. on Painf. and Nerv. Dis.* p. 91. 1837.

³ *An Inquiry into the Medicinal Properties of the Aconitum Napellus*, by A. Fleming, M. D.

⁴ *Brit. and For. Med. Rev.* i. 249.

⁵ *Lancet*, March 25, 1837.

aconite, in which the tincture was probably that which is known as Fleming's tincture.—ED.] "The patient was a young man of the age of 21, who had been suffering from acute articular rheumatism for some days previous to his admission. He took five drops of the tincture, three times a day, for two days, without marked relief. On the third day this dose was increased to six drops, and was ordered to be taken with the same intervals between the doses as formerly. Unfortunately, however, these directions were not adhered to, for the first dose of six drops was administered at nine o'clock A. M., and the second at eleven. At twelve o'clock, the hour of visit of the physicians, the man was found in a state of extreme restlessness, and complaining of great pain in various parts of his body. To use his own expression, 'he felt as though his skin were too tight for his body.' In imploring relief, he described his sensations as most intolerable. At this time there was much frothing at the mouth, with violent retching at intervals. The surface of the body was cold, and bathed in profuse perspiration, which ran down his face in streams. The pulse, though at first 150 in the minute, fell to between 50 and 60 in a few minutes, and was so small and compressible as scarcely to be felt at the wrist. Brandy and water was ordered to be given internally in repeated doses, and warmth was also applied to various parts of the surface. In six hours afterwards the man had almost wholly recovered, and had lost all his rheumatic pains, which never returned. It may be stated that in this case, as well as in three others in which the same tincture was administered, the dose of four or five drops almost invariably produced decided effects, viz. tingling and numbness of the limbs, and very generally relief of the pain."

2. *TINCTURA ACONITI FOLIORUM*, U. S.; *Tincture of Aconite Leaves*.—Take of Aconite Leaves $\mathfrak{z}\text{iv}$; Diluted Alcohol Oij. Macerate for fourteen days, express, and filter through paper. This tincture may also be prepared by thoroughly moistening the aconite leaves in powder with diluted alcohol, allowing the mixture to stand for twenty-four hours, then transferring it to a percolator, and gradually pouring upon it diluted alcohol until two pints of filtered liquor are obtained. This preparation is weaker than the preceding.—The dose is grt. x—xx.]

3. *EXTRACTUM ALCOHOLICUM ACONITI* [*Extractum Aconiti Alcoholicum*, U. S.]; *Alcoholic Extract of Monkshood*.—(Prepared by distilling the spirit from the tincture, until the consistence of an extract has been obtained.)—It has been employed internally in doses of one-sixth of a grain every three hours. It should be given in the form of pills (*pilulæ aconiti*) made of liquorice powder and syrup. It may be also employed externally in the form of ointment (*unguentum aconiti*), composed of one part of the extract and two parts of lard (Turnbull), or spread on adhesive plaster.

[The formula of the *U. S. Pharm.* is as follows: Take of Aconite Leaves, in coarse powder, $\mathfrak{H}\text{ij}$; Diluted Alcohol Oiv. Moisten the powder with half a pint of the diluted alcohol, and, having allowed the mixture to stand for twenty-four hours, transfer it to a percolator, and add gradually the remainder of the diluted alcohol. When the last portion of this has penetrated the powder, pour in sufficient water from time to time to keep the mass covered. Cease to filter when the liquor which passes begins to produce a precipitate as it falls in that which has already passed. Distil off the alcohol from the filtered liquor, and evaporate the residue to the proper consistence.]

4. *EXTRACTUM ACONITI*, L. E. [U. S.]—(Fresh Aconite Leaves $\mathfrak{H}\text{ij}$. Bruise the leaves in a stone mortar; then press out the juice, and evaporate it, unstrained, to a proper consistence, *L*.—"Take of the leaves of monkshood, fresh, any sufficient quantity; beat them into a pulp; express the juice; subject the residuum to percolation with rectified spirits, so long as the spirit passes materially coloured; unite the expressed juice and the spirituous infusion; filter; distil off the spirit, and evaporate the residuum in the vapour-bath, taking care to remove the vessel from the heat so soon as the due degree of consistence shall be attained," *E*.)—An uncertain

preparation. When of good quality it causes numbness and tingling, within a few minutes after its application, in the mouth and lips. The tincture or alcoholic extract are, in my opinion, greatly to be preferred to this variable preparation—Dose, one or two grains at the commencement, and to be gradually increased until some obvious effect is produced.

5. *ACONITINA*; *Aconitine*.—The following directions for making this alkaloid were given in the former *London Pharmacopæia*. The alkaloid is now, however, altogether excluded:—

“Root of Aconite, dried and bruised, ℥ij; Rectified Spirit, Cong. iij; Diluted Sulphuric Acid; Solution of Ammonia; Purified Animal Charcoal, each as much as may be sufficient. Boil the Aconite with a gallon of the Spirit for an hour, in a retort with a receiver adapted to it. Pour off the liquor, and again boil the residue with another gallon of the Spirit, and the Spirit recently distilled, and pour off the liquor also. Let the same be done a third time. Then press the Aconite, and, all the liquors being mixed and strained, let the Spirit distil. Evaporate what remains to the proper consistence of an extract. Dissolve this in water, and strain. Evaporate the liquor with a gentle heat, that it may thicken like a syrup. To this add of dilute Sulphuric Acid, mixed with distilled water, as much as may be sufficient to dissolve the Aconitina. Then drop in solution of Ammonia, and dissolve the Aconitina precipitated in diluted Sulphuric Acid and water, mixed as before. Afterwards mix in the Animal Charcoal, frequently shaking them during a quarter of an hour. Lastly, strain, and solution of Ammonia being again dropped in, that the Aconitina may be precipitated, wash and dry it.”

Aconitina exists in the plant in combination with a vegetable acid (aconitic acid?). Alcohol extracts this salt with some other matters. The alcoholic extract yields this salt to the water, and on the addition of sulphuric acid a sulphate of aconitina is formed, which is decomposed by ammonia, and the aconitina precipitated. It is then again dissolved by sulphuric acid, the solution decolorized by charcoal, and the aconitina again precipitated by ammonia. As prepared by Mr. Morson, this substance presents the following properties: It is a white, odourless solid, either dull and amorphous or somewhat sparkling, and apparently crystalline. As it is usually described as being uncrystallizable, I have carefully examined a supposed crystalline mass with the microscope, but I could not detect distinct crystals. The fragments appeared like thin plates of chlorate of potash, and, though they varied greatly in shape, the triangular form seemed predominant. Heated in a tube, aconitina readily fuses, and forms a pale amber-coloured liquid; and at a higher temperature it is decomposed. It is not volatile. Heated on platinum foil, over a spirit-lamp, it is speedily and entirely dissipated. It is soluble in alcohol, ether, and the acids. From its acid solution it is precipitated by ammonia. A minute portion of it mixed with lard, and applied to the eye, causes *contraction* of the pupil, as I have repeatedly seen. Geiger and Hesse state, that the aconita which they obtained produces *dilatation* of the pupil. Mr. Morson's aconitina is so powerful that one-fiftieth of a grain has endangered the life of an individual. It is the most virulent poison known, not excepting hydrocyanic acid.

The following notes were formerly appended to it in the *London Pharmacopæia*:—

“An alkali prepared from the leaves and root of aconite. It is very soluble in sulphuric ether, less in alcohol, and very slightly in water. It is totally consumed in the fire, no salt of lime remaining. This substance, possessing strong power, is not to be rashly employed.”

A spurious aconitina is found in the shops. It is imported from France, and bears the stamp and label of a celebrated French chemical firm. Its colour is grayish-yellow. It is inert, or nearly so; at least I have taken one grain of it without perceiving the least effect of it on the tongue or otherwise. It is not completely soluble either in ether or alcohol. When burnt on platinum foil, it leaves a calcareous residue. The only genuine aconitina which I have met with is that manufactured by Mr. Morson, of Southampton Row; and Dr. Turnbull informs me that he has found none other to possess any medicinal value. Mr. Skey also found this to be the case.¹

¹ See *Lond. Med. Gaz.* xix. 185.

The effects of this alkaloid are similar to those of aconite root, but, of course, much more powerful. If the ointment, or an alcoholic solution of this substance, be rubbed on the skin, it causes intense heat, tingling, and numbness, which continue for more than twelve or eighteen hours. A minute portion of an ointment, composed of a grain of the alkaloid to two drachms of lard, applied to the eye, causes almost insupportable heat and tingling, and contraction of the pupil. This last effect was shown me by Dr. Turnbull, in some amaurotic cases of several years' standing; the pupils underwent no change when the eye was exposed to strong daylight. In very minute doses it has caused heat and tingling upon the surface of the body, and sometimes diuresis; but it cannot be administered internally with safety. In one case (an elderly lady), one-fiftieth of a grain had nearly proved fatal. Satisfied that great insecurity attends its internal use, Dr. Turnbull tells me he has long since ceased to employ it in this way, as the slightest inattention on the part of the dispenser may be attended with fatal results. The enormous cost (3s. 6d. per grain!) of Morson's aconitina limits its use. I believe that the alcoholic tincture is a perfect substitute for it; and the experience of others confirms my own observation. Of the great efficacy of aconitina in neuralgic and rheumatic affections, no one can entertain any doubt who has submitted the remedy to trial.¹ The following are Dr. Turnbull's formulæ for using aconitina externally:—

1. *Unguentum Aconitinæ; Aconitine Ointment.* (Aconitine gr. xvj; Olive Oil 3ss; Lard 3j. Mix.)—It is employed by friction with the finger during several minutes.

[Dr. Fleming recommends for external use the following preparation: Take of Aconitina gr. xvj; Spir. Rectif. ℥. xvj; Lard 3j. Rub together and make an Ointment. One or more drachms of the tincture may, according to Dr. Fleming, form an excellent substitute for the ointment in external use; but, when there is any abrasion of the skin, the use of any of these preparations is attended with danger.—En.]

2. *Solutio Aconitinæ; Aconitine Embrication.* (Aconitine, gr. viij; Rectified Spirit 3ij. Dissolve.)—Used by friction: sponge (as a sponge tooth brush). Care must be taken not to employ it where the skin is abraded.

[348. CIMICIFUGA RACEMOSA.—BLACK SNAKEROOT.

Sez. Syst. Polyandria, Monogynia.
(*Cimicifuga*, *U. S.*—The Root.)

BOTANY. Gen. Char.—*Sepals* four to five. *Petals* (or rather staminodia) three to five, concave or unguiculate, sometimes by abortion few or none. *Stamens* numerous; *anthers* retrorse. *Style* short; *stigma* simple. *Carpels* one to eight, follicular, many-seeded. *Perennial herbs.* *Leaves* two to three ternately divided, segments incisely serrate. *Flowers* in virgate racemes, white. (Torrey and Gray, *Flor. of North America*).

Sp. Char.—*Racemes* very long; *leaflets* ovate oblong, incisely toothed; *staminodia* slender, two-forked (*Ell. Sk.* ii. p. 16). *Root* thick and knotted, with long fibres. *Stem* three to eight feet high, glabrous, furrowed, leafy near the middle. *Leaves* three, ternate; *leaflets* two to three inches long. *Racemes* branching, six to twelve inches long; *pedicels* three to four lines in length, bracteate. *Flowers* very fetid. *Sepals* caducous, greenish-white, concave. *Staminodia* four to eight. *Carpels* globose ovate, glabrous. *Seeds* seven to eight, compressed and angular. De Candolle states that the flowers are sometimes digynous, but we have never observed more than a single ovary in a flower (T. and G. *op. cit.* vol. i. p. 36).

Hab.—This plant is known by the names of *Tall Snakeroot*, *Black Snakeroot*, and *Rich Weed*. Its size and the long white racemes of flowers make it a conspicuous ornament of our woods.

It is abundant in open woods and on hillsides throughout the United States, from Canada to Florida. It flowers in June and July.

The root as found in the shops is composed of a rough tuberculated head and

¹ See Dr. Turnbull, *op. supra cit.*; Mr. Skey, *Lond. Med. Gaz.* vol. xix. p. 181.

numerous radicles, seven inches long, of a black colour externally, white internally. The radicles are extremely brittle and liable to be separated. The odour is feeble and earthy; the taste bitter and astringent, leaving an impression of acrimony upon the palate. The sensible properties depend upon the time when the root is collected, and the mode of drying and preserving it. It should be collected late in the summer, or in the autumn.

COMPOSITION.—An analysis made by Mr. Tilghman, resulted in the detection of the following substances: *Fatty matter, gum, starch, resin, tannin, wax, gallic acid, sugar, oil, black colouring matter, green colouring matter, lignin, and salts of lime, iron, magnesia, and potassa.* The experiments, however, led to no decided conclusion as to the nature of the active principle. "The peculiar bitterness and nauseating properties of the plant seemed more fully developed in the ethereal extract than in any other form." (*Am. Journ. of Pharm.* vol. vi. p. 20.)

MEDICAL PROPERTIES.—Considerable variance of opinion has existed with regard to the influence this medicine is capable of exerting upon the animal economy. By the late Professor B. S. Barton, it is stated to be astringent; he farther informs us that "in a putrid sore throat, which prevailed many years ago in Jersey, a strong decoction of the roots was used with great benefit as a gargle." Dr. Mears, who tried the medicine upon himself, reports a decided impression upon the brain, evinced by a distressing pain in the head and giddiness; it also increased the force and fullness of the pulse, and produced a flushed condition of the face; uneasiness of the stomach, and violent efforts to vomit were also among the symptoms experienced by him (*Phil. Monthly Journ. of Med. and Surg.* Sept. 1827). Dr. Garden had previously mentioned the tendency to affect the brain, which is compared to digitalis; this writer also states that it operates powerfully upon the secreting organs and absorbents, and that, when exhibited in large doses, nausea, vertigo, anxiety, great restlessness, pains in the extremities, &c. were occasioned (Togno and Durand in *Translation of Manual of Edwards and Vavasour*, p. 339). Dr. Chapman, speaking of this article, informs us that he has never been able to discover the astringent action in any great degree, but that it is "expectorant, narcotic, antispasmodic, diaphoretic, and in large doses emetic. Given so as to affect sensibly the system, we find, first, some nausea, followed by greater freedom of expectoration, and more or less relaxation of surface, with slight nervous tremors and vertiginous affection. The pulse during this state is considerably lowered, and is apt to remain so for some time." (*General Therapeutics.*) In addition to these views with regard to the medicine, it may be farther stated that it has been regarded as having a control over the uterus. The diseases to which it has been applied are as diversified as the effects just referred to. Dr. Garden thought highly of it in phthisis pulmonalis, but that the diagnosis was strictly accurate cannot be assumed; the probability is that it proved beneficial rather in simulative cases. It is not difficult to understand how service can be obtained in humoral asthma, catarrh, and analogous affections, in which it has been recommended, by a stimulating impression upon the mucous membrane, and the promotion of healthy expectoration. The evidence of a favourable action in rheumatism is of a decided character. In the wards of Professor Dunglison, at the Philadelphia Hospital, it has been used with benefit. He informs us that "when pushed so as to produce catharsis, and even slight narcosis, it certainly appeared to be of service in the acute forms." (*General Therapeutics and Mat. Med.* vol. ii. p. 194.) In the chronic form, we should expect much more to be accomplished by it.

In chorea, it is highly spoken of. Several years ago, Dr. Young (*American Journ. of Med. Science*, vol. ix.) brought cimicifuga before the profession as a remedy in this disease, and his results have to a certain extent been verified by other physicians. Professor Wood found that a case under his care yielded to it, after the failure of purgatives and metallic tonics. The latter author also exhibited it satisfactorily in a case of convulsions occurring periodically, and connected

with uterine disorder. In these cases, however, its precise mode of operation is obscure.

Black snakeroot may be given in powder, in doses of half a drachm, two or three times daily.

The decoction is made by boiling for a few minutes $\mathfrak{z}\text{j}$ of the contused root in Oj of water. The dose is $\mathfrak{z}\text{j}$ or $\mathfrak{z}\text{ij}$, two or three times daily. This is a better form than the powder.

The tincture may be made with $\mathfrak{z}\text{iv}$ of the bruised root, and Oj of Diluted Alcohol. The dose is gtt. xx to $\mathfrak{f}\mathfrak{z}\text{j}$, two or three times daily. This preparation is adapted to rheumatic cases.

349. COPTIS TRIFOLIATA, *Salsb.* — GOLDEN THREAD.

Ser. Syst. Polyandria, Polygynia.

(*Coptis*, *U. S.*—The Root.)

BOTANY. *Gen. Char.*—*Sepals* 5 to 6, petaloid, deciduous. *Petals* 5 to 6. *Stamens* 15 to 25. *Follicles* 5 to 10, on long stipes, somewhat stellately diverging, membranaceous, ovate oblong, pointed with the style, 4- to 8-seeded. *Herbs* with radical, divided, subcoriaceous leaves, and very slender, extensively creeping roots.

Sp. Char.—*Leaves* 3-foliate; *leaflets* cuneiform-obovate, crenately and mucronately toothed, obscurely 3-lobed; *scape* 1-flowered. *Roots* consisting of long bright yellow fibres, intensely bitter. *Leaves* evergreen; *leaflets* about an inch long. *Scape* slender, three to five inches high. *Sepals* 5 to 7, oblong, obtuse, white. *Petals* much shorter than the sepals, yellow at base. *Carpels* acuminate with the persistent style. *Seeds* oblong, black, and shining; *raphe* very indistinct. (Torrey and Gray, *Flor. of North Amer.* i. 28.)

Hab.—This plant is found in mountain bogs, from Greenland and Labrador to Pennsylvania.

The root, which is the officinal portion, is brought into the market in the dried state. It is filamentous, threadlike, and of a deep golden-yellow colour, very brittle. The fibres are usually commingled with the leaves of the plant. By the Shakers, the whole plant appears to be compressed into the square form. It has no odour; the taste is bitter without astringency.

This article of the *Materia Medica* is ranked among the pure bitters, as its medicinal properties appear solely to depend upon a bitter extractive matter. It may be employed as a tonic under circumstances calling for the exhibition of such remedies, and may be ranked with *sabattia* and that class of articles, acting as a stomachic, improving the appetite, &c. It is not as powerful as gentian, quassia, and other pure bitters. In the treatment of aphthous sore mouths of children, it has been used as an application in New England.

The mode of employment may be in the form of *infusion*, which may be made in the proportion of $\mathfrak{z}\text{ss}$ to Oj of Water.—Dose, $\mathfrak{z}\text{j}$ to $\mathfrak{z}\text{ij}$.

A *tincture* is made by macerating $\mathfrak{z}\text{j}$ of the Root in Oj of Alcohol.—Dose, $\mathfrak{f}\mathfrak{z}\text{j}$ to $\mathfrak{f}\mathfrak{z}\text{ij}$.

The dose of the powder is gr. xx to $\mathfrak{z}\text{j}$. An extract might be prepared.

OTHER MEDICINAL OR POISONOUS RANUNCULACEÆ.

1. The leaves of *HELLEBORUS FÆTIDUS* are emetic and purgative. They have been employed as a vermifuge against the large round worm (*Ascaris lumbricoides*).

2. *HELLEBORUS VIRIDIS* possesses similar properties.

3. *ACONITUM FEROX* is, perhaps, the most violent of the ranunculaceous poisons. It is a Nepaul plant, and constitutes the *Bish* or *Bikh* poison of that country. Several years since, I undertook, at the request of Dr. Wallich, to examine the effects of this plant on animals. My

experiments were made with plants which had been ten years in Dr. Wallich's possession, and which, therefore, had doubtless lost part of their activity; yet their effects were most energetic (Wallich's *Plantæ Asiaticæ rariorēs*; and the *Ehnb. Journ. of Nat. and Geogr. Science*, July, 1830, p. 235), but of the same nature as those of *Aconitum Napellus*.

The *DELPHINIUM CONSOLIDA* is official in the *U. S. Pharmacopœia*.

ORDER LXXXIX. PODOPHYLLÆ.—*Lind.*

ESSENTIAL CHARACTER.—*Sepals* 3 to 4, deciduous or persistent. *Petals* in 2, 3, or more rows, each of which is equal in number to the sepals. *Stamens* hypogynous, 12 to 18, arranged in two, three, or more rows; *anthers* linear, oval, turned inwards. *Stigma* somewhat peltate. *Fruit* succulent or capsular, 1-celled. *Seeds* indefinite; *embryo* small.

Herbs.—*Leaves* broad-lobed. *Flowers* radical, solitary, white (Beck).

PODOPHYLLUM PELTATUM, *Linn.* — MAY-APPLE.

Sex. Syst. Polyandria, Monogynia.

(*Podophyllum*, *U. S.*—The Root.)

BOTANY. *Gen. Char.*—*Sepals* 3. *Petals* 6 to 9. *Stamens* 12 to 18. *Stigma* large, subsessile, peltate. *Berry* somewhat fleshy, not dehiscent. *Seeds* many.

Sp. Char.—*Stem* erect, 2-leaved, 1-flowered; *fruit* ovate.

The common names by which this plant are known are *May-Apple* and *Hog-Apple*. It has a large, horizontal, creeping, perennial root; the stem is from eight to twelve inches high, naked, with sheathing stipules at the base, dichotomous at the summit, dividing into two petioles two to four inches in length, each bearing a peltate leaf. The leaf is large, hanging, divided into five to seven lobes, cuneate, oblong, dentate, and often bifid at the apex. Flower solitary in the axil of the petioles; peduncle recurved, white. The fruit is an oval berry, an inch and a half long, smooth, yellowish when mature, succulent, and pulpy, having a mawkish sweet taste, edible, but not agreeable.

Hab.—*May-Apple* is common throughout the United States, in moist woods and shady situations along the banks of rivulets. It flowers in May.

In the dried state, the root is found in pieces several inches in length, the thickness of quills; some of them are knotty and swollen at intervals (jointed), and beset with the remains of the radicals, somewhat corrugated and wrinkled; externally the colour is deep brown or blackish; internally dingy white. The fracture is short. The entire root has little odour; the taste is sweetish, bitter, and somewhat acid.

The powder is grayish; it has somewhat the odour of *ipœcacuanha*.

CHEMICAL COMPOSITION—*Podophyllum* has been examined with the view to determine its constituents. Dr. E. Staples found it to contain resin, starch, and a peculiar vegetable substance crystallizable in white silky tufts. (Togno and Durand, *Translation of Edwards and Vavasour's Manual*.) Mr. Hodgson obtained from it also a peculiar principle. To this the name *Podophylline* has been given.

PODOPHYLLINE. (Hodgson.)—When dry, this substance is in pale brown scales of considerable lustre; is easily pulverized, is unalterable in the air, and has a strong bitter taste. It is copiously soluble in strong alcohol, and much more so in boiling than in cold water, the aqueous solution retaining when cold about a grain to the ounce. It is soluble to some extent in sulphuric ether. It is readily separated from water by muriatic acid, is coloured red by nitric acid, and becomes first olive or green, and subsequently purple by sulphuric acid. Exposed to heat it fuses, blackens, and dissipates in black smoke. (*Journ. of Phil. Col. of Pharm.* vol. iii. 275.) It has not as yet been determined whether this or the resin is the active principle.

MEDICAL PROPERTIES.—*May-Apple* root is an active cathartic, resembling jalap in its action upon the bowels. It stimulates the muciferous glands and exhalants, and occasions watery discharges; in too large quantities, giving rise to tormina. It is highly spoken of by many eminent writers, who have tested its efficacy. Dr. Eberle (*Mat. Med.*) says he very frequently gave it instead of jalap, and always found it active and safe in its operation. Dr. Burgon regarded it as slower in its

operation than the article mentioned, but as leaving the bowels longer in a lax and soluble condition. (*Med. Recorder*, iii. 332.) The cases to which it is adapted are of an inflammatory character, especially at the commencement, where brisk purging is required. In bilious fever and intermittents, it has been much used throughout the country. Combination with calomel or cremor tartar increases its certainty, and at the same time moderates its drastic action. In overdoses, it occasions tormina and tenesmus, and hypercatharsis with muco-bloody discharges; it also nauseates the stomach and induces emesis.

The leaves of the plant and young shoots are said to be highly poisonous.

The dose of the powdered root is from ten to twenty grains.

EXTRACTUM PODOPHYLLI, U. S. This preparation is made in the same way as the Extract of Jalap. It has the advantage over the crude medicine of being given in smaller bulk, and may be substituted for it, or for the extract of Jalap.—Dose, ten to fifteen grs.]

ORDER XC. JUGLANDEÆ.—*De Cand., Lind.*

ESSENTIAL CHARACTER.—*Flowers* diclinous. *Sterile flowers* in an ament. *Perianth* scaly, oblique, irregularly lobed. *Stamens* inserted on the receptacle, indefinite (three to thirty-six); *filaments* short, distinct; *anthers* thick, two-celled, bursting longitudinally. *Fertile flowers* with a single or double perianth, the outer four-parted, the inner (when present) of four pieces. *Ovary* inferior, one-celled; *ovule* solitary, erect; *styles* one to two, very short or none; *stigmas* large, either two and lacerated or discoid and four-lobed. *Fruit* drupaceous, one-celled, with four imperfect partitions. *Seed* four-lobed; *embryo* large; *albumen* none; *cotyledons* fleshy, two-lobed, wrinkled; *radicle* superior.

Trees.—*Leaves* alternate, unequally pinnate (Beck).

JUGLANS CINEREA, Linn.—BUTTERNUT.

Sex. Syst. Monœcia, Polyandria.

(Juglans, U. S.—The inner Bark of the Root.)

BOTANY. Gen. Char.—Monœcious. *Sterile flowers*; ament imbricate, scales mostly five-parted. *Perianth* five to six-parted. *Stamens* eighteen to thirty-six. *Fertile flowers*; *perianth* double, each four-parted. *Styles* one or two. *Drupe* partly spongy; *nut* rugose and irregularly furrowed.

Sp. Char.—*Leaves* pinnate; *leaflets* numerous, lanceolate; serrate rounded at the base, soft pubescent beneath; *petioles* villous; *fruit* oblong ovate, with a terminal projection, viscid and hairy, on a long peduncle; not oblong, acuminate, conspicuously sculptured (Beck, *Botany of North. and Mid. States*, 335).

This plant is the *J. cathartica* of Michaux. The common names by which it is known are *White Walnut* and *Butternut*. In some situations it is a large tree, with numerous branches and a smooth cinereous bark. The fruit is less rank and strong than the black walnut, but by age becomes rancid and unpleasant; it abounds in oil. Early in the spring, if the bark be pierced, there exudes a saccharine juice.

Hab.—Butternut abounds in Canada and the northern and middle sections of the United States, in rich bottom lands and along streams. It flowers in May, and the fruit ripens in September and October.

The inner bark, when first separated from the tree, is of a pure white colour, but soon begins to change, and by the time it becomes dry, is of a deep brown colour. It comes into the market in pieces, which have a fibrous fracture. If the epidermis has not been removed, they are smooth externally. The inner bark is the officinal portion; that from the root is most active. When in the fresh state a rubefacient effect is stated to be made upon the skin. The period for collecting it is in May. The odour is feeble, and the taste is bitter and pungent.

COMPOSITION.—Mr. S. Wetherill found in this bark *fixed oil*, *resin*, *saccharine matter*, *lime*, and *potassa*, a *peculiar principle* (*extractive?*), and *tannin*. (*Unpub-*

lished Essay). Dr. Bigelow did not find tannin by the action of gelatine. Mr. Wetherill, however, found a precipitate afforded by standing.

EXTRACTUM JUGLANDIS, U. S. *Extract of Butternut*.—This is the officinal preparation, which is mostly used. It is made by displacement from the bark, in coarse powder, by means of water, and evaporating the solution. It is of a black colour, having a caramel-like odour, and bitter astringent taste. It is a pretty certain mild cathartic, operating without pain or irritation, and evacuating the alimentary canal without depletion. For a long time it has been employed as a purgative throughout the country, and is one of the articles to which Dr. Rush directed attention. Dr. Barton, in his *Collections*, also speaks highly of it. By all the subsequent writers upon *Materia Medica*, it is noticed as one of the most valuable of our indigenous productions. The cases to which it is adapted are, fevers, with disturbance of the liver and congestion of the abdominal organs, habitual costiveness, and dysenteric affections. By combination with a mercurial, as blue pill or calomel, its powers are increased. The dose is 10 to 30 grains, in pill. The extract which is brought in from the country, and made by decoction, is objectionable, from the little care taken in its preparation.

A decoction is sometimes used, but the taste and the quantity required render it inferior to the officinal preparation.

ORDER XCI. GERANIACEÆ, *De Cand., Linn.*

ESSENTIAL CHARACTER.—*Sepals* five, persistent, more or less unequal, with an imbricate aestivation; sometimes saccate or spurred at the base. *Petals* five (or by abortion four, rarely none), unguiculate. *Stamens* usually monadelphous, hypogynous, twice or thrice as many as the petals. *Ovary* composed of five pieces, placed round an elevated axis, each one-celled, one-seeded; *ovules* pendulous; *styles* five, cohering round the axis. *Fruit* formed of five carpels cohering round the axis, having a membranous pericarp and terminated by an indurated style, which finally twists and carries the pericarp, along with it. *Seeds* solitary, pendulous; *albumen* none. *Embryo* curved; *radicle* pointing to the base of the cell; *cotyledons* foliaceous, convolute, and plaited.

Herbs or shrubs.—*Stems* tumid and separate at the joints. *Leaves* either opposite or alternate (Beck).

GERANIUM MACULATUM, *Linn.*—SPOTTED GERANIUM.

Sex. Syst. Monadelphia, Decandria.

(*Geranium*, *U. S.*—The Root.)

BOTANY. Gen. Char.—*Sepals* five, unequal. *Petals* five, equal. *Stamens* alternate, fertile ones larger, and with nectariferous scales at the base. *Carpels* with long awns, at length separating elastically from the summit to the base; awns smooth internally (Beck).

Sp. Char.—*Root* perennial, irregularly gibbous and horizontal, brownish, mottled with green externally, and greenish-white internally. From the root spring a number of radicle leaves and one or more stems; these are erect and terete, of a green colour, and furnished with reflexed hairs. At the height of six, eight, or ten inches from the ground, the stem becomes forked; and at the point of division is furnished with two large petiolate leaves, which are generally reflexed. *Leaves* on the upper part of the stem either with very short petioles or sessile. The peduncles arise from the dichotomous divisions of the stem, and support two flowers on short pedicles. The calyx consists of five oval, lanceolate, ribbed, cuspidate segments, plumosely ciliate at their outer margin, and membranous on the other; sometimes three of the segments only are ciliate. *Petals* five, obovate, not emarginate. *Stamens* ten, furnished at the base with glands, and terminated by oblong, convex, deciduous anthers of a purple colour. Germ ovate. *Style* persistent, the length of the stamens at first, but afterwards elongated. *Stigmas* five. *Capsule* containing five seeds, which,

when mature, becomes detached by the elasticity of the awns (Griffith, *Am. Journ. of Pharm.* vol. iv. p. 90).

The common names for this plant are *Crowfoot* and *Crane's bill*. It is a handsome plant, of which there are several varieties, varying in the form of the foliage and colour of the flower; these depend upon soil and situation. The most usual colour of the flower is lilac.

Hab.—The *geranium maculatum* is common throughout the United States, growing in hedges and borders of damp woods. It flowers in May.

In the dried state, the root presents itself in pieces an inch or two in length, and three to four lines thick, corrugated, wrinkled, and rough, with a few fibres attached; externally the colour is brown, internally dingy white. It breaks with a short fracture. The odour is feeble, the taste astringent and bitter. The powder is gray.

CHEMICAL COMPOSITION.—From Dr. Staples's analysis, it appears that *Geranium* contains *gallic acid* in large quantity, *tannin*, *mucilage* in a small proportion, *amadin*, *red colouring matter*, principally in the external covering of the root, *resin* in small quantity, and a crystallizable vegetable substance (*Journ. of Phil. Col. Pharm.* i. 171).

MEDICAL PROPERTIES.—*Geranium* is an astringent of some power, and the therapeutical uses to which it has been put, are based upon this action. It early attracted the attention of those who were inquiring into the remedial value of indigenous plants, and has been uniformly spoken of by all subsequent writers upon the same subject. In its effects and range of application it differs not from others of the same class; more powerful than some, and less so than others. In hemorrhages and bowel affections, under the appropriate pathological conditions calling for their exhibition, *geranium* may be administered with advantage. As a local application in chronic inflammation, ulceration, &c., benefit may equally be expected from it, as for instance in the form of a gargle where the throat is involved, and in that of injection in gonorrhœa and leucorrhœa. The forms of exhibition are varied.

If the powder be used, the dose is from 10 to 30 grains. The *decoction* is made by boiling an ounce of the bruised root for a few minutes in a pint of water. Dose, f̄j to f̄ij. An *infusion* may be prepared in the same manner. A *tincture* and an *extract* may be prepared from it.

ORDER XCII. CORNACEÆ, *De Cand.*—THE DOGWOOD TRIBE.

ESSENTIAL CHARACTER.—*Calyx* adherent to the ovary; *limb* four to five-toothed, minute or four to five-lobed, with a valvate aestivation. *Petals* distinct, equal in number to the teeth of the calyx, and inserted alternately with them into the margin of the hypogynous disk, broad at the base; *aestivation* valvate. *Stamens* four to five, inserted with the petals, and alternate with them; *anthers* introrse, mostly cordate. *Ovary* one-celled, with solitary pendulous ovule in each cell; *styles* single. *Drupe* baccate with a one to two-celled nucleus, crowned with the remains of the calyx. *Seeds* anatropous. *Embryo* nearly the length of the fleshy albumen; the radicle shorter than the oblong cotyledons.

Trees or *shrubs*, rarely herbaceous, with a bitter bark. *Leaves* opposite (or rarely somewhat alternate), mostly entire, exstipulate, pinnately veined. *Flowers* cymose; the inflorescence sometimes capitate and involucrate, rarely diœcious. *Hairs* centrally affixed. (Torrey and Gray.)

CORNUS FLORIDA, *Linn.*—DOGWOOD.

Sex. Syst. Pentandria, Monogynia.
(*Cornus Florida*, *U. S.*—The Bark.)

BOTANY. **Gen. Char.**—*Limb* of the *calyx* four-toothed, minute. *Petals* oblong, spreading. *Filaments* filiform. *Style* subelavate; *stigma* obtuse or capitate. *Drupe* not connate into a syncarpium. *Leaves* entire, minutely scabrous, with the appressed bicuspitate hairs. *Flowers* white, rarely yellow. (T. and G.)

Sp. Char.—*Leaves* of the involucre four, obovate, or with a callous notch at the apex; *drupes* oval; *leaves* ovate acuminate.

Fig. 421.

*Cornus Florida.*

Dogwood is a small tree, varying in height from 15 to 20 or 30 feet, rarely attaining more, with an irregular growth. The branches are numerous and expanded. It is a conspicuous ornament of the forest in the spring of the year, when the large leafy involucre are expanded and resemble showy white flowers diffused in every direction. Within the involucre are the flowers, in clusters, rather inconspicuous, greenish-yellow. The leaves are developed after the flowers. In the fall of the year they become deep red. The drupe or berry is bright red when mature.

Hab.—This plant is common throughout the United States, growing in open woods in moist soil from Canada to Florida and Louisiana. Its growth is modified by the climate; to the south it attains its extreme size. In the northern sections of the country the time of flowering is May, but in the southern it is during March and April.

The bark of the tree constitutes the officinal portion; that from the root is regarded as most efficacious. It is brought into the market in pieces slightly quilled, several inches long, half an inch to two broad, and two or three lines thick, of a grayish-red colour, breaking with a short fracture, and exposing lighter-coloured surfaces, mottled with red and white. The pieces from the root are rougher externally and more frequently destitute of epidermis. The odour is feeble; the taste bitter and astringent, with a little aroma. In the fresh state the taste is a little acid.

CHEMICAL COMPOSITION.—Dr. Walker, who analyzed the bark, announced that it contained *gum, resin, tannin, and gallic acid*. To these have since been added, by Mr. Cockburn (*Am. Journ. of Pharm.* vol. vii. p. 114), *oil, fatty matter, a crystalline substance, bitter extractive, wax, red colouring matter, lignin and potassa, iron, lime, and magnesia*. From his experiments, it appeared that the bitterness alone resided in the extractive matter, from which the crystalline substance was obtained.

A principle, to which the name *cornine* was given, was several years since announced, but has not been subsequently obtained by analysis.

MEDICAL PROPERTIES.—The article under consideration is a decided roborant, and hence has been placed by systematic writers in the list of tonics. By Dr. Walker it was found to augment the force and frequency of the pulse and to increase the heat of the body. It also has an astringent effect. An analogy has been supposed to exist between its mode of operation and that of cinchona, but it does not seem to be possessed of more than a general invigorating effect. As a substitute for bark or its preparations, dogwood has been employed in the treatment of intermittent fever, and in domestic practice is much used. Advantage has also been derived from it in the hands of regular practitioners. The objection to its use, however, is the large doses required, which disorder the stomach. As a mere tonic it is applicable to the same range of cases as other of its congeners. The recent bark is apt to disagree with the stomach and produce pain.

Dogwood bark may be given in powder, infusion, decoction, or extract. The dose in substance is ℥j to ℥j.

DECOCTUM CORNUS FLORIDE, U. S.; *Decoction of Dogwood Bark.*—(Take of Dogwood, bruised, an ounce; Water a pint. Boil for ten minutes in a covered vessel, and strain the liquor while hot.)—Dose, f℥j to ℥ij.

Two other species of CORNUS, the *C. CIRCNATA* and *C. SERICEA* have been placed in the secondary list of the *United States Pharmacopœia*. Both of these are shrubs. The bark is in the quilled form. The medical properties are nearly similar to those of the *C. florida*. They are employed in the same way and for the same purposes.—J. C.]

II. The Animal Sub-Kingdom.

Division I. Invertebrata.—Invertebral Animals.

CHARACTERS—Animals destitute of a *vertebral column* and an *internal skeleton*. *Skin* sometimes ossified, and thereby forming an *external skeleton*. *Nervous system* not always evident.

SUBDIVISION I. ACRITA, *Macleay*.

Nervous system indistinct, diffused, or molecular (Owen).¹

Class I. Poriphera, *Grant*.—Poripherous Animals.

CHARACTERS.—Simple, soft, aquatic *animals*, with a fibrous *axis*, without perceptible *nerves* or *muscular filaments*, or *organs of sense*, or any *circulating* or *glandular organs*. Their body is composed of a soft gelatinous *flesh*, traversed internally with numerous ramose, anastomosing canals, which commence from superficial minute *pores*, and terminate in larger, open *vents*.²

350. SPONGIA OFFICINALIS, *Linn. E.*—THE OFFICINAL SPONGE.

(Sponge, *E.*)

HISTORY.—Aristotle³ was acquainted with the sponges, and notices the popular but erroneous opinion of their shrinking when attempted to be plucked.

ZOOLOGY. Gen. Char.—Body soft, very elastic, multiform, more or less irregular, very porous, traversed by numerous tortuous canals, which open externally by very distinct vents (*oscula*), and composed of a kind of subcartilaginous *skeleton*, anastomosed in every direction, and entirely without spicules (De Blainville).⁴

My friend, Mr. J. S. Bowerbank,⁵ has recently shown that spicula do exist in the keratose or horny sponges of commerce. They are imbedded, to a greater or less extent, in the substance of the fibre, and are mostly to be observed in the larger flattened portions of the fibre, and not in the finer anastomosing threads. Mr. Bowerbank has also shown that the fibre of the true sponges is solid, and not tubular, as commonly supposed.⁶

Sp. Char.—*Masses* very large, flattened and slightly convex above, soft, tenacious, coarsely porous, cracked and lacunose, especially beneath. *Vents* round, and for the most part large (Lamouroux).⁷

These characters are insufficient to distinguish the officinal sponge from numerous other allied species; and it is tolerably clear, from Mr. Bowerbank's discoveries, above alluded to,

¹ *Cyclop. of Anat.* art. *Acrita*.

² *Hist. d. Anim.* lib. i. cap. ix. p. 16, Tolosæ, 1619.

³ *The Microscopic Journal*, i. 8.

⁴ The only tubular sponge known to Mr. Bowerbank is *Spongia fistularis*. This, however, he proposes to separate from the genus *Spongia*, and to give it the generic name of *Fistularia*.

⁵ *Hist. des Polyp. Corall.* p. 20, 1816.

⁶ Grant, *Brit. Annual* for 1838, p. 267.

⁷ *Man. d' Actinol.* p. 529, 1834.

that the naked eye is incompetent to distinguish species of this curious genus, and that the microscope must be principally, if not wholly, relied on for ascertaining specific characters. Mr. Bowerbank has recognized three distinct species in the sponges of commerce.

The animality of sponge is by no means universally admitted; indeed, a considerable number of the naturalists of the present day regard it as of vegetable origin; and its position, in a natural classification of plants, it is said, should be between Algæ and Fungi.¹ But the recent observations of Mr. Bowerbank appear to me to be conclusive as to its animality. In one species of sponge he detected a branched vascular system, with globules in the vessels analogous to the circular blood-disks of the higher animals. Now, nothing analogous to this has hitherto been detected in plants. The sponge derives its food from the fluid in which it lives. The water (containing the matters necessary for the existence of the animal) enters by the superficial pores, circulates through the anastomosing canals, and is expelled by the fecal orifices or vents, carrying along with it particles which separate from the sides of the canals.²

Sponge adheres to rocks by a very broad base. When first taken out of the sea it has a strong fishy odour. Its colour varies from pale to deep brownish-yellow. It often contains stony or earthy concretions (*lapides spongiarum*), which Bley³ found to consist principally of the carbonates of lime and magnesia. Shells also are found in sponges. Various marine animals pierce and gnaw it into irregular holes.

Hab.—In the Red and Mediterranean Seas. Chiefly collected about the islands of the Grecian Archipelago.

COLLECTION.—The inhabitants of the Greek islands collect sponge by diving for it. In their submarine operations, they carry with them a knife. Practice enables them to remain a considerable time under water.⁴ As soon as the sponge is brought on shore, it is squeezed and washed to get rid of the gelatinous matters; otherwise putrefaction speedily ensues.

DESCRIPTION.—Commercial sponge (*spongia*) is the dry skeleton of the animal, from which the gelatinous flesh has been removed, as just mentioned. When deprived of stony concretions, &c. found in the interior of the mass, it is soft, light, flexible, and compressible. When burnt, it evolves an animal odour. It absorbs water, and thereby swells up. Nitric acid colours it yellow. Liquor potassæ dissolves it; the solution forms a precipitate on the addition of an acid. The finer sponges, which have the greatest firmness and tenacity, were formerly called male sponge; while the coarser portions were denominated female sponge.

In 1841, duty (6*d.* per lb., with an additional 5 per cent. on the duty) was paid on 58,931 lbs. of sponge.

In English commerce⁵ two kinds of sponge are met with, which are respectively known as Turkey and West Indian.

a. Turkey Sponge.—This is imported from Smyrna, and constitutes the best sponge of the shops. It occurs in cup-shaped masses of various sizes. Its texture is much finer than the West Indian kind. Mr. Bowerbank, by the aid of the microscope, has discovered that it consists of two species of *Spongia*, not distinguishable from each other by the naked eye. One of these is characterized by the presence of a beautiful, branched, vascular tissue, which surrounds, in great abundance, nearly every fibre of its structure, and is inclosed in an external membrane or sheath. In the other and most common kind of Turkey sponge, no vascular tissue has yet been discovered. The common variety is called *honeycomb* sponge.

β. West Indian Sponge.—The principal source of this is the Bahama Islands; whence it is commonly known as *Bahama Sponge*. Its forms are more or less con-

¹ S. e. Hogg, in the *Linn. Trans.* vol. xviii. pp. 363 and 368; also, Johnson's *History of British Zoophytes*, ed. 1835.

² Grant, *Outlines of Comparative Anatomy*, p. 310, Lond. 1836.

³ *Pharm. Central Blatt für 1834*, S. 273.

⁴ Savary, *Letters on Greece*, p. 109, Lond. 1788. [Dr. Lefevre, of Rochefort, found that among the Naurino sponge divers, accustomed as they were to the practice of diving, there was not one who could sustain entire submersion of the body for two consecutive minutes. The average period of entire submersion was seventy-six seconds.—Ed.]

⁵ On the continent, a considerable variety of sponges are known. See Baudrimont, in the *Dict. de l'Industrie*, t. iv. art. *Eponge*; and Dr. T. W. C. Martius's *Lehrbuch der Pharmaceutischen Zoologie*, Stuttgart, 1835.

vex, with projecting lobes. Its fibre is coarser. Its tissue has but little cohesion, and hence this kind of sponge is commonly regarded as rotten. Mr. Bowerbank states that it consists of one species only of *Spongia*.

COMPOSITION.—Well-washed sponge, freed as much as possible from earths and salts by dilute acids, was analyzed, in 1828, by Hornemann,¹ who found it to consist of a substance similar to osmazome, animal mucus, fat oil, a substance soluble in water, a substance only soluble in potash, and traces of chloride of sodium, iodine, sulphur, phosphate of lime (?), silica, alumina, and magnesia. Mr. Hatchett² found sponge to consist of *gelatine* (which it gradually gave out to water), and a thin, brittle, membranous substance, which possessed the properties of *coagulated albumen*.

According to the experiments of Posselt,³ the substance of sponge is peculiar, and stands near the horny substance, from which, however, it is distinguished both in composition and properties. It, nevertheless, is not a proteine compound, nor does it contain a trace of such a body.

USES.—The extensive economical uses of sponge are familiar to every one. To the surgeon it is of great value on account of its softness, porosity, elasticity, and the facility with which it imbibes fluids. Its use at surgical operations and for checking hemorrhage is well known.⁴ It has also been applied to wounds and ulcers for imbibing acrid discharges.⁵ The *sponge-tent* is usually made of compressed sponge impregnated with wax (*spongia cerata*), and which is called *prepared sponge* (*spongia præparata*). It is prepared by dipping sponge into melted wax, and compressing it between two iron plates till the wax hardens. It was formerly much used for dilating sinuses and small openings, but it is seldom resorted to now.

SPONGIA USTA; *Pulvis spongiæ ustæ*; *Calcined or Burnt Sponge*.—Formerly in the Dublin Pharmacopœia, and directed to be prepared as follows: Having cut sponge into pieces, beat it to free it from little stones; burn it in a closed iron vessel until it becomes black and friable, and reduce it to powder. Preuss⁶ calcined 1,000 parts of sponge: of these, 343.848 parts were destroyed by heat. The residue consisted of carbon and siliceous insoluble matters, 327.0; chloride of sodium, 112.08; sulphate of lime, 16.430; iodide of sodium, 21.422; bromide of magnesium, 7.570; carbonate of lime, 103.2; magnesia, 4.73; protoxide of iron, 28.720; and phosphate of lime, 35.0.—Burnt sponge, if good, should evolve violet fumes (*vapour of iodine*) when heated with sulphuric acid in a flask. It has been employed as a resolvent in bronchocele, scrofulous enlargement of the lymphatic glands, &c.—Its efficacy is referable to iodine and bromine. Iodine is now almost invariably substituted for it.—Dose, ʒj to ʒiij. It is given in the form of electuary or lozenges (*burnt sponge lozenges*; *trochisci spongiæ ustæ*.) [A decoction of burnt sponge is, when filtered, colourless. When treated with starch and chlorine, it strikes a blue colour, showing the presence of an iodide.—Ed.]

Class II. Polypiphera, Grant.—Polypipherous Animals.

The polypipherous animals have received their name from the circumstance of their bearing tubes called *polypes*. They consist of two parts, a skeleton and a fleshy portion. The *skeletons*

¹ Berl. Jahrb. Bd. xxx. Abt. ii.

² Annalen der Chemie und Pharmacie, Bd. xlv. Heft 2, p. 192, Feb. 1843.

³ Phil. Trans. for 1800, p. 327.

⁴ C. White, An Account of the Topical Application of the Sponge in the Stoppage of Hemorrhage, Lond. 1762.

⁵ On the Use of Sponge after Amputations, by Mr. T. Kirkland, in the Med. Observ. and Inq. vol. ii. p. 278, Lond. 1764.

⁶ Pharm. Central-Blatt für 1837, 169.

Fig. 422.

*Corallium Rubrum.*

vary in their consistence, and also in their position relative to the soft parts. They are soft and flexible, or hard and calcareous. They are external and tubular, or internal and solid. The *fleshy portion* may be, with respect to the skeleton, either external or internal. It gives origin to fleshy tubes (*polypes*), each of which, at its external orifice, is surrounded by *tentacula*.

The calcareous internal skeleton of *CORALLIUM RUBRUM*, Lamarck (*Isis nobilis*, Pallas; *Gorgonia pretiosa*, Ellis), is the *Red Coral* of the shops. It consists of carbonate of lime principally coloured with oxide of iron. *Prepared Red Coral* (*Corallium rubrum preparatum*) was formerly used in medicine, but it presents no advantage over chalk. Its powder, obtained by levigation, or an imitation of it, is still kept in the shops, and is occasionally employed as a dentifrice. [According to Witting, 100 grains of red coral yield the following constituents:—

Carbonate of lime	83.25
Carbonate of magnesia	3.50
Oxide of iron	4.25
Animal gelatine and sand	7.75
Loss	1.25
	100.00]

SUBDIVISION II. RADIATA, *Lamarck*.--RADIATE ANIMALS.

CHARACTERS.—*Nervous system* distinct, composed of filaments and rudimentary ganglia; the filaments arranged circularly around the buccal orifice (*Cyclo-neura*).

No officinal substance is obtained from the Radiata.

SUBDIVISION III. MOLLUSCA, *Latreille*.—MOLLUSKS OR SOFT ANIMALS.

MALACOZOA, *Blainville*.—*CYCLO-GANGLIATA*, *Grant*.

CHARACTERS.—Inarticulated animals with a soft not annulated *skin*. *Cerebral ganglia* arranged circularly around the *oesophagus*.

Class III. Conchifera, *Lamarck*.—Conchiferous Mollusks.

CHARACTERS.—Acephalous, aquatic mollusks, with a bivalve or a multivalve *shell*. *Organs of respiration* 4 pectinated laminæ. *Heart* simple. *Impregnation* effected without the assistance of a second individual.

351. OSTREA EDULIS, *Linn*.—COMMON EDIBLE OYSTER.

(The shells burnt, of former *Ph. Lond.*)

[*Testa*, *U. S.*]

HISTORY.—Oysters were greatly admired by the Romans as a most delicious article of food.¹ Those of Britain were much esteemed; though they were said to be inferior to those of *Cyzicena* (Pliny).²

ZOOLOGY. *Gen. Char.*—*Body* compressed, more or less orbicular. Edges of the *mantle* thick, non-adherent, or retractile, and provided with a double row of short and tentacular filaments. The two pair of *labial appendices* triangular and elongated. A subcentral bipartite *muscle*. *Shell* irregular, inequivalved, inequi-

¹ Pliny, *Hist. Nat. lib. xxxii. cap. 6*, ed. Valp.

² Juvenal, *Sat. iv.*

lateral, coarsely laminated. *Left* or *inferior valve* adherent, largest, and deepest; its summit prolonged, by age, into a kind of keel. *Right* or *upper valve* smallest, more or less operculiform. *Hinge* oral, toothless. *Ligament* somewhat internal, short, inserted in a cardinal pit, growing with the summit. The *muscular impression* unique and subcentral (Blainville).

Sp. Char.—*Valves* ovate-roundish or obovate; the upper one flat. *Lamellæ* of both valves imbricated and undulated (Brandt).¹

Brandt² has given an elaborate account of the anatomy of the oyster, to which I must refer the student interested in these details.

Hab.—European and Indian seas. Our own coasts furnish some of the finest kinds.

OYSTER FISHERIES.—Oysters are caught by dredging. In order to improve their flavour and size they are laid on beds in creeks along shore, where they rapidly improve. Colchester and other places of Essex, as well as some parts of the coast of Kent, are the nurseries or feeding-grounds for the metropolis.³

DESCRIPTION.—The official parts of oysters are the *shells* (*testæ ostrææ*). The hollow halves are preferred, as they contain more carbonate of lime. When calcined, oyster-shell yields a quicklime, formerly much esteemed as a lithontriptic.

COMPOSITION.—*Oyster-shells* have been analyzed by Bucholz and Brandes,⁴ and by Rogers.⁵ The *flesh of the oyster* has been analyzed by Pasquier.⁶

Bucholz and Brandes's Analysis.		Pasquier's Analysis.	
Carbonate of lime	98.6	Osmazome	12.6
Phosphate of lime	1.2	Gelatine	
Alumina	0.2	Mucus	
Albuminous matter	0.5	Albumen	
		Fibrine	
Oyster Shells	100.5	Water	87.4
		Flesh of the Oyster	100.0

The dietetical properties of oysters have been before noticed.

TESTÆ PRÆPARATÆ, Testæ Ostreorum Præparatæ [*Testa Præparata*, U. S.]; *Prepared Oyster-Shells* of former *London Pharmacopœia*.—Wash the shells, first freed from impurities, with boiling water; then prepare in the same manner as directed for chalk. The mode of preparing chalk by elutriation has been already described. After oyster-shells have been washed, boiled, and crushed, they are dried and ground to an impalpable powder previous to elutriation. In the shops the substance sold as prepared oyster-shells is in small conical masses. The principal constituent of prepared oyster-shells is carbonate of lime, and they therefore possess the same medicinal properties as chalk, already described, and which is usually substituted for them.

Class IV. Cephalopoda, Cuvier.—Cephalopods.

CHARACTERS.—*Body* inclosed in a bag (*mantle*). *Head* protruding from the bag, crowned with inarticulated arms, furnished with cups or suckers, and surrounding the mouth. *Eyes* two, sessile. *Mouth* with two horny mandibles. *Hearts* three. *Sexes* separate.

¹ Med. Zool.

² Ibid. Bd. ii.

³ For details respecting the treatment of oysters in beds, see Spratt's *History of the Royal Society*, p. 307. "In the fish-shops, the oysters are laid with their flat sides uppermost; they would die were it otherwise. The animal breathes and feeds by opening its shell, and thereby receiving a new portion of water into the concavity of its under-shell. Oysters, when packed in barrels, should be laid in the same position. "Geologists can tell whether oysters were overwhelmed in their native beds, or rolled away and scattered as shells, by determining their position." (Paley's *Theology*, by Bell, vol. ii. pp. 220—221.)

⁴ Gmelin, *Handb. d. Chem.* ii. 1177.

⁵ Silliman's *Journal*, vol. xxvi. p. 361.

⁶ Gmelin, *op. supra cit.*

352. *SEPIA OFFICINALIS*, Linn.—COMMON CUTTLE-FISH.

The substance called *os sepiae* or *cuttle-fish bone* is an oval or oblong calcareous bone (sometimes termed a *shell*) deposited in the mantle of the animal. The common species of *sepia* is *S. officinalis*, Linn.; but *S. elegans*, Blainville, also yields part of the cuttle fish bone of the shops.¹

Os sepiae has a cellular texture, and is so light as to float on water. It is cast in considerable quantities on the shore, and is collected for commercial purposes. It was analyzed by John, who found the constituents to be as follows:—

	Hard upper or outer Portion.	Porous Part.
Carbonate (with a trace of phosphate) of lime	80	85
Non-gelatinous animal matter, soluble in water with some common salt	7	7
Gelatinous membrane not soluble in water	9	4
Water, with a trace of magnesia	4	4
	<hr/> 100	<hr/> 100

Reduced to powder it is used as a dentrifice. It is employed for several purposes in the arts, as for polishing, for forming moulds for small silver castings, and as a pounce.

SUBDIVISION IV. ARTICULATA, Cuvier.—ARTICULATED ANIMALS.

CHARACTERS.—*Skin* annulated. *Muscles* attached to the inner surface of the skin. *Nervous system* of two cords extended along the ventral surface of the body, with ganglionic enlargements at intervals (*diplo-neura*); the anterior ganglion (brain) placed over the œsophagus.

Class V. Annulosa, Macleay.—Annulose Animals.

ANNELIDES seu ANNELIDA.

CHARACTERS.—*Body* more or less elongated. *Skin* soft, segmented and annulated. *Articulated members* and *wings* absent. *Blood* red.

353. *SANGUISUGA*, Savigny.—BLOODSUCKING LEECHES.

Iatrobdella, Blainville.

HISTORY.—We have no accurate knowledge of the exact period when leeches either became known to, or were employed by, man; but this deficiency of information is not necessarily referable to their discovery preceding the date of our historical documents. It is true that in the common version of our most ancient record, the Bible,² this passage occurs: "The horseleech hath two daughters, crying, Give, give;" but critics are not agreed as to the correctness of this translation. The word "*Olukeh*," or "*Aluka*," here interpreted "*horseleech*," means, according to Bochart, destiny or fate, either of which terms should, according to this writer, be substituted for that of horseleech; the daughters alluded to being Eden and Hell. But the Vulgate, Greek, and Lutheran translations are all against his opinion. Brandt³ has entered into a very elaborate discussion of this subject, from which it appears that, in Arabic, the term *Aluka* indicates a leech, while *Aluk* signifies fate; the latter being derived from *Alaka*, to attach or hang to, because every man's fate is supposed to be appended to him, just as a leech affixes itself to the body; so that from this it appears probable the word "*Olukeh*" of the Old Testament really refers to the leeches. Nay, I think there is some reason for suspecting that the *Sanguisuga ægyptiaca* is the species referred to. The leeches referred to by Herodotus,⁴ are *Bdella nilotica* (Savigny).

¹ Brandt and Ratzeburg, *Med. Zoolog.* ii. 599.

² *Med. Zool.* ii. 231.

³ *Prov.* xxx. 15.

⁴ *Euterpe*, lxviii.

But admitting that these animals were known at this early period, it does not appear that they were employed in medicine: for Hippocrates makes no mention of them, though he notices other modes of drawing blood. Aristotle also is silent with regard to them. In the extracts which Cælius Aurelianus has made from the writings of Diocles, Praxagoras, Herophilus, Heraclides, Asclepiades, and other ancient physicians, who lived between the time of Hippocrates and Themison, no mention is made of the employment of leeches; a remarkable fact in favour of the opinion that they were not at this period in use. In fact, the founder of the Methodic sect, Themison, is the first person in whose works we find mention of leeches being employed therapeutically.¹ However, it does not follow that he was the first who prescribed them, though our documentary evidence fails in tracing back their use beyond his time.

In the Latin and Greek languages, the animal has received its name from its sucking or drawing qualities. Thus, the Greeks called it βδέλλα, from βδέλλω, to suck; the Romans *hirudo*, probably from *haurio*, to draw out; or *sanguisuga*, literally signifying "bloodsucker," from *sanguis* and *sugo*. It would appear, however, that the latter of these two Latin terms is the more modern; for Pliny,² in speaking of elephants, says: "Cruciatum in potu maximum sentiunt, hausta, hiru-dine, quam sanguisugam vulgo cœpisse appellari adverto."

ZOOLOGY. Gen. Char.—*Jaws* with two rows of pointed, numerous *teeth*, which are mutually inclined at an acute angle (Brandt).³

Body elongated. *Back* convex. *Belly* flat. *Extremities* somewhat narrowed, furnished with disks or suckers; the anterior extremity somewhat narrower than the posterior one. *Rings* from ninety to a hundred. *Eyes* represented by ten blackish points. *Mouth* tri-radiate. *Jaws* cartilaginous, armed with numerous cutting teeth. *Anus* small, placed on the dorsum of the last ring.

Cuvier⁴ includes all leeches in the genus *Hirudo*; but later naturalists have found it necessary to arrange them in several genera. The leeches employed in medicine have been formed into a distinct genus, called by Blainville⁵ *Iatrobellula* (from *ιατρὴς* and *βδέλλα*, a leech), by Savigny,⁶ *Sanguisuga*. The latter classical term, so expressive of the bloodsucking properties of the genus, I have adopted. All leeches, it appears, are not provided with an apparatus for perforating the skin of vertebrate animals. In consequence of the numerous complaints addressed to the Préfet de Police, in 1825, that of the leeches sold in Paris some would not bite, while others caused painful and obstinate wounds, he consulted the Council de Salubrité, who deputed MM. Pelletier and Huzard fils, to inquire into the accuracy of the statements. One of the results of the investigation was, that the animal called in France *horseleech*, and which had been particularly charged with causing painful wounds, could not perforate the human skin, the teeth of the animal being quite blunt.⁷ The horseleech referred to, the reporters declared to be *Hæmopsis sanguisorba*, Savigny; but Blainville says it was *Hæmopsis nigra*.

Species.—I. *SANGUISUGA OFFICINALIS*, Savigny; *Hirudo provincialis*, Carena, Mem. della Reale Accad. di Torino, xxv. 282; *Sanguisuga meridionalis*, Risso, Hist. Nat. de l'Europe mérid. t. iv. p. 428; the *Green Leech*.—*Back* greenish or blackish-green, with six rusty-red band-like [longitudinal] stripes. *Belly* olive-green, unspotted (Brandt).—South of Europe. Those brought to England come from Bordeaux, Lisbon, and Hamburg.

Moquin-Tandon⁸ admits three varieties:—

- α. Dorsal bands interrupted at intervals.
- β. Dorsal bands reduced to blackish spots.
- γ. Dorsal bands united by transverse ones.

2. *SANGUISUGA MEDICINALIS*, Savigny; *Hirudo medicinalis*, Linn. L. D.; *True English* or *Speckled Leech*.—*Back* greenish or olive-green, with six rusty red longitudinal stripes, which are mostly spotted with black. *Belly* greenish-yellow, spotted with black (Brandt).—*Spots* very variable in size and number; in some cases they are but few; in others, are so numerous as to form the almost

¹ Le Clerc, *Hist. de la Méd.* p. 442, nouv. éd. 1720.

² *Med. Zool.* ii. 231.

³ *Dict. des Sciën. Nat.* t. xlvii. art. *Sangsue*.

⁴ *Journ. de Pharm.* t. xi.

⁵ *Hist. Nat.* viii. 10, ed. Valp.

⁶ *Règne Animal*, nouv. éd. t. iii. p. 212, 1830.

⁷ *Desc. de l'Égypte. Hist. Nat.* t. i. part. iii. p. 114.

⁸ *Monogr. de la fam. des Hirud.* p. 112.

prevailing tint of the belly, the intervening spaces appearing like greenish-yellow spots.—Europe, especially the northern parts. A native of England, but rare. Imported from Hamburg.

Several varieties of this leech have been described and figured. One of the most remarkable of these is the *flesh-coloured medicinal leech* (*Sanguisuga medicinalis carnea*) described by Guillez of Paris. The anterior half of its body is flesh-coloured; while the posterior half is of the usual colour. The *spotted* or *piebald leech* is flesh-coloured, with olive-green spots.¹

These are the only species employed in medicine in this country. Others have been described and figured by Brandt.² The following is a short sketch of the *anatomy of the medicinal leech* :—

The **CUTANEOUS SYSTEM** of the animal consists of a transparent *epidermis* (which is thrown off from the body every four or five days) and the *corium*. The latter consists of condensed cellular tissue, composed, according to Brandt, of globules. Like the epidermis, it shows the partitions into rings. It contains a number of *globules* impregnated with a pigment varying in colour in different places, and which is the source of the colours presented by the surface of the animal.

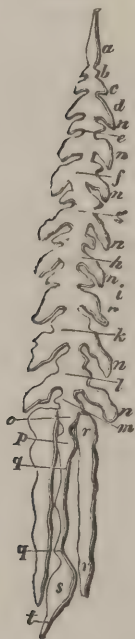
It is asserted that the predominant or base colour is, in part at least, owing to the colour of the soil in which the animals are found. Dr. J. R. Johnson³ says: "Mr. Baker, a man of some intelligence, residing in Glastonbury, and who for the last twenty years has been in the habit of

collecting large quantities of leeches for sale, informs me that, at the Black River, near Glastonbury, they are black, from the peat being of that colour; at Cook's Corner, they are of a reddish cast, from the red peat; while at Auler Moor, where, from a deficiency of peat, they penetrate the clay, they are yellow."

The **MUSCULAR SYSTEM** has been elaborately described by Brandt, but can scarcely be comprehended without the aid of drawings. The muscles of the trunk are arranged circularly, longitudinally, and obliquely; of these, the circular fibres are the most external, and the longitudinal ones the most internal.

The **DIGESTIVE SYSTEM** consists of a mouth, alimentary tube, anus, salivary glands, and liver. The *mouth* is placed in the middle of the oval or buccal disk; its shape is triradiate; that is, of three equidistant lines or rays meeting in the centre. Within it are three white sublingular *jaws* (*dentiferous tubercles* or *piercers*), which in appearance are cartilaginous; but Brandt says they consist of a strong firm skin, inclosing a muscular mass. On the free-curved sharp margin of each jaw are about sixty small, finely-pointed *teeth*. The *œsophagus* is a muscular tube, and dilates as it approaches the stomach; but at its termination it contracts into a small circular aperture, its whole length not exceeding a quarter of an inch. The *stomach* occupies two-thirds of the length of the animal, and is divided into about eleven compartments or cells, each of which, from the second to the eleventh, gives off on each side a *æcal sac*, those of the last cell being by far the largest, and extending down by the side of the intestine as far as the commencement of the rectum. The stomach consists of three coats, a cellular, a muscular, and a mucous coat. Its eleventh cell terminates by a funnel-shaped projection in the intestine. The *intestine* is about an inch in length; at its upper orifice is a valve, and at its lower end a sphincter; on either side of it, for the greater part of its length, is one of the sacs for the last compartment of the stomach; on its inner surface are several folds. It is divided into *small* and *large intestine*, the lower part of the latter being called a *rectum*. The *anus* is not, as we might anticipate, in the posterior disk, but on the dorsal surface of the last ring. *Salivary organs* have been described; they consist of whitish granular masses placed around the *œsophagus*, into which tube the common salivary duct opens. De Blainville, Carus, and Brandt, speak of a *liver*. It is a brownish mass placed on the alimentary canal, the ducts opening into the stomach and intestine. The best mode of displaying the cells of the stomach is to immerse a leech, fully gorged with blood, for a week in a saturated solution of corrosive sublimate.

Fig. 423.



Alimentary Canal of the Leech.

- a. *Æsophagus*.
- b, c, d, e, f, g, h, i, k, l, m. Cells of the stomach.
- n. *Cæcal sacs*.
- o. Funnel-shaped pylorus.
- p. Irregularly expanded commencement of (q) the small intestine.
- r. *Cæcal sac* of the last cell of the stomach.
- s. *Large intestine*.
- t. *Rectum*.

¹ See Brandt and Ratzeburg, *Med. Zool.*

² *Treat. on the Med. Leech*, p. 42, 1816.

³ *Med. Zool.* ii.

The **VASCULAR SYSTEM** consists of four great pulsating *vessels*, giving off numerous ramifying branches; but without any heart, commonly so called. Two of these are placed laterally, a third in the median line of the dorsal surface, and a fourth on the abdominal surface. All these vessels pulsate (Johnson). We know very little about the manner in which the blood circulates. Brandt thinks that the lateral vessels must be arteries, on account of their very distinct transverse and longitudinal fibres; the dorsal and venous vessels he terms veins.¹ Does not the dorsal vessel correspond to the vena cava, and the abdominal vessel to the vena porta, of higher animals? Grant,² however, terms the dorsal vessel of the annelides an artery.³

The **RESPIRATORY SYSTEM** consists of small apertures (called *stigmata* or *spiracula*) arranged in two rows on the abdominal surface, and occurring at every fifth ring. They lead into little cavities lined by mucous membrane, and which have been called *air sacs*, *pulmonary vesicles*, *mucous bags*, *cryptæ*, or *lateral vesicles*, containing usually a whitish fluid. They are placed on each side of the alimentary canal, in the spaces between the cæcal sacs of the stomach, and are usually regarded as organs of respiration. Brandt, however, asserts that the respiratory function is effected solely by the skin, and that these vesicles are, in fact, receptacles for mucus secreted by a neighbouring *glandular apparatus*, which has a whitish appearance, and in form represents a folded intestine. This notion, however, is not new, but was held by De Blainville and Johnson.

The **NERVOUS SYSTEM** consists of two parts: *one* (which we may compare to the *cerebro spinal axis* of the vertebrata) consists of a chain of ganglia (usually about twenty-three in number) occupying the mesial line of the abdomen, and connected by a double nervous cord; the first ganglion (*brain*) is placed on the œsophagus, and supplies the eyes and neighbouring muscles. The *second* part of the nervous system is that lately discovered by Brandt, and may be regarded as a kind of *sympathetic system*. It consists of three ganglia (connected to the brain by filaments, and supplying the jaws), and a single nerve connected to them, and running along the abdominal surface of the stomach in the mesial line.

Of the **EXTERNAL SENSES**, three only have been recognized; *feeling*, which resides in the external surface of the body; *taste*, apparently indicated by the fondness of leeches for certain fluids (as blood, milk, &c.); and *vision*, effected by ten eyes (in the form of black spots) arranged in a crescent form at the anterior or cephalic extremity of the animal.

The **SEXUAL SYSTEM** is double; that is, each animal is androgynous, or possesses both male and female organs. There is, however, no power of self-impregnation (the contact of two individuals being requisite, each acting to the other in a double capacity of male and female). The **MALE ORGANS** consist of several pairs of *testicles*, *two vasa deferentia*, *two vesiculæ seminales*, *two ejaculatory ducts*, and a *penis* surrounded at its base by what some have termed a *prostate gland*. The penis projects from the abdominal surface at about one third distant from the anterior extremity. The **FEMALE ORGANS** consist of *two ovaries*, *two oviducts* (which subsequently unite into one), a hollow organ (*uterus*), which opens by a contracted aperture (*vagina*) externally at about the twenty ninth ring, or five rings below the penis.

That leeches are essentially oviparous admits of no doubt; and we have now an admirable account of their development by Professor Weber.⁴ It appears that soon after copulation an unusual activity pervades the ovaries, in consequence of which some *ova* (termed by Weber *germs*, by Carus *yelks*) are separated, and pass along the oviduct to the uterus, where they stop, in order to obtain the matters necessary for their development, and their proper coats. They here become invested with a serous like membrane, on the inner side of which is produced (either by secretion from the uterine cavity, or from the membrane itself) an albuminous whitish mucus, serving in part for the nourishment of the ova, and which is regarded as a kind of *liquor amnii*. Subsequently, a glutinous fluid is deposited on the outside of the serous coat. When the ova are expelled from the uterus, part of this fluid gives a coating to them, while part is expelled before and after them. But this coat seems now distended with air-vesicles, and

Fig. 424.



Ventral Surface of the Leech.

- a. Anterior disk.
- b. Posterior disk.
- c. Penis.
- d. Vaginal orifice.
- e. Stigmata.

¹ Med. Zool. t. ii. 249.

² Some interesting observations on the vascular system of leeches are contained in Knol's *Nat. Abhandl.* 2b. d. Bluteigel, Wien, 1820.

³ Meckel's *Archiv* for 1828, p. 366.

⁴ *Outl. of Comp. Anat.* 440.

has the frothy appearance of well-beaten white of egg, produced by the violent contraction of the uterus.

The animals usually deposit their ova (in their own native waters) in holes or moist places on the shore, from May to the end of September. When first expelled, they are somewhat cylindrical in form, and have a brownish appearance. The frothy layer adheres very slightly; but, after lying in the water for a quarter of an hour, the outer surface becomes somewhat hardened, forming a kind of pellicle or fine skin. After some days, a portion of this frothy covering is converted into a spongy tissue (*spongy coat of the cocoon*), covering the capsule of the ova (*cocoon*) wholly or partially. In this state, the cocoon has a brownish, fibrous appearance, similar to fine sponge, and varies somewhat in its size and weight; its longest diameter being from six to twelve lines, its shortest from five to eight, and its weight from twenty-four to twenty-eight grains.¹

The ova or germs, which have a lenticular form, evince vital movements; and very soon we perceive a funnel-shaped tube, extending from their surface inwards, and which appears to absorb the albumen of the cocoon. The ovum goes on enlarging, and becomes somewhat elongated, and subsequently the young leech begins to be developed on the exterior part of the ovum, the aperture of the funnel being the spot where the mouth of the young animal is observed. The abdominal surface is the first, the dorsal the last to be developed. When the young leeches have attained a considerable size they pierce their cocoon.

Fig. 425.

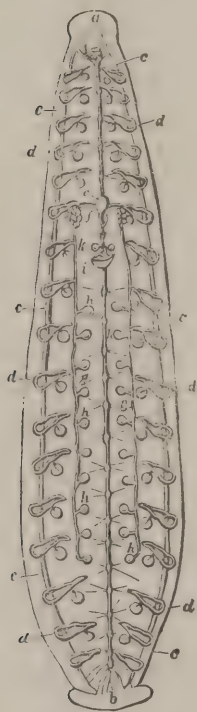


Diagram illustrative of the internal anatomy of the leech.

- a. Brain.
- b. Last ganglion.
Between these will be observed the chain of ganglia of which they form portions.
- c. Lateral or branchial vessels.
- d. Folded mucous glands; each is connected by a duct to an air-vesicle.
- e. Penis, the rounded enlarged base of which is supposed to contain the prostate gland.
- f. Vesicle seminales.
- g. Vasa deferentia.
- h. Testicles.
- i. Uterus.
- k. Ovaries.

DISEASES OF LEECHES.—The natural duration of the life of leeches is not easily determined; but judging from the slowness of their growth, and the length of time full-grown leeches have been preserved, we may necessarily infer that they are long-lived animals. Dr. Johnson thinks that, in their native waters, if they can always meet with an abundant supply of food, they may live at least twenty years. But they are subject to several diseases, some of which are epidemic, and of a very destructive kind. Although the study of the pathology of this animal is of considerable interest in a commercial and even scientific point of view, yet no practically useful results have hitherto been arrived at, in regard to the prevention and treatment of the diseases of leeches. Dr. J. R. Johnson mentions three diseases as common to this animal: 1st. An ulcer, seated in various parts of the body, but more generally affecting the side. It destroys life in a few days. 2d. A rigidity and narrowing of one part, whilst another portion is studded with tumours of putrid coagulated blood. 3d. A flaccid appearance of the whole body, except the lips, which are hard, swollen, purple, and frequently bloody. These diseases are particularly prevalent during the summer months. Brostat² describes three epidemic disorders.

COLLECTION AND COMMERCE OF LEECHES.—Leeches may be caught with the hand, or by a kind of net (described by Derheims), or by the gatherers going into the ponds with naked feet, to which the leeches adhere; or by baits, especially the liver of animals. The two latter methods are objectionable; one, because it is not free from danger to the gatherers, and the other because it is apt to injure the health of the animal. An interesting and graphic account of the leech fishery at La Brenne, and of the miserable appearance of the fisherman who collects the leeches,

¹ See figures of the cocoon in Dr. J. R. Johnson's *Farther Observations on the Medicinal Leech*, 1825.

² Brandes's *Archiv*, Bd. v.

by allowing them to attach themselves to his legs and feet, has been published in the *Gazette des Hôpitaux*. A translation of this paper is given in McCulloch's *Dictionary of Commerce*. Leeches are largely imported from Hamburg. The Hamburg dealers draw their supplies from the Ukraine. "Having exhausted all the lakes of Siberia, Bohemia, and other more frequented parts of Europe, the buyers are now rolling gradually and implacably eastward, carrying death and desolation among the leeches in their course, sweeping all before them, till now they have got as far as Pultava, the pools and swamps about which are yielding them great captures."¹ Leeches are sometimes imported in bags, but more usually in small barrels, each holding about 2,000, the head being made of stout canvas to admit the air. The best vessels for preserving these animals are unglazed brown pans or wooden tubs. The dealers have a notion (and possibly a correct one) that the leaden glazing is injurious. These pans should be very little more than half-filled with soft water (pond, river, or rain water). This does not require changing so often as is commonly supposed. In very hot weather, or when the water has become bloody, or otherwise much discoloured, it should be changed every day or so; otherwise, in summer, every four or five days, or a week; in winter, once a month is believed by large dealers to be sufficient.

The consumption of leeches must be enormous. Some years ago it was stated that four principal dealers in London imported, on the average, 600,000 monthly, or 7,200,000 annually.² Feé³ says: "It is estimated that 3,000,000 are annually consumed in Paris; and, as the population of Paris is to that of the whole of France as one is to thirty-three, it follows that, independently of exportation, 100,000,000 are consumed annually, which is equivalent to three leeches annually for each person. Now, if we estimate the average price at fifty francs per thousand, we shall have the enormous sum of five millions of francs paid for this one article of our *materia medica*."

MODE OF BITING.—Having fixed on a suitable spot, the animal applies his oval disk, and firmly fixes it (at first, perhaps, by atmospheric pressure; then by intimate contact), so that the anterior end forms an angle with the other portions of the body. The three cartilaginous jaws bearing the sharp teeth are now stiffened and protruded through the triradiate mouth against the skin, which they perforate, not at once, but gradually, by a saw-like motion. Dr. Johnson⁴ says: "The jaws are carried from side to side in an oblique direction;" and adds, "their action may be seen by presenting to the leech a coagulum of blood, and when the leech is in the act of suction, cautiously removing it. For a few seconds it appears unconscious of its removal, which presents a fair opportunity of observing the oscillatory movement of each piercer." The wound is not produced instantaneously, for the gnawing pain continues for two or three minutes after the animal has commenced operations. Thus, then, it appears that the leech saws the skin; hence the irritation and inflammation frequently produced around the orifices. The flow of blood is promoted by the suction of the animal, which swallows the fluid as fast as it is evolved. During the whole of the operation the jaws remain lodged in the skin. In proportion as the anterior cells of the stomach become filled, the blood passes into the posterior ones; and when the whole of this viscus is distended, the animal falls off. On examination, it will be found that not a particle of blood has passed into the intestine.

¹ Bremner. *Excurs. in the Interior of Russia*, vol. ii. p. 408, 1839. [In some parts of England, more particularly in the fenny districts of Cambridgeshire and Lincolnshire, the trade in leeches forms a valuable branch of business. The manner in which the leeches are taken is this: Two or three persons, furnished with long poles, enter the marshes with their shoes and stockings off, and continue beating the weeds and rushes for some time. The leeches being disturbed by this proceeding, are aroused from their wonted lethargy, and, impelled by hunger, the effect of long abstinence, seize with avidity the first animal object they meet with. The feet and ankles of the leech-catchers being exposed to them, the same are freely fastened upon by the leeches, and they are thence removed and deposited in a basket carried for the purpose of receiving them. When taken home, they are washed in a weak solution of salt and water, and when purified are carefully packed in wet linen cloths, and in this manner are dispatched to the different leech merchants and the various medical establishments throughout the country.]

² Price, *Treat. on Sanguisuct.* p. 129, 1822.

³ *Treat.* p. 112.

⁴ *Cours. d'Hist. Nat.* t. i. p. 21.

PHYSIOLOGICAL EFFECTS.—There are two classes of phenomena observed in all modes of drawing blood; one of which has been termed *local*, the other *general*. In phlebotomy and arteriotomy, the first is trifling, and of no therapeutic value; and we resort to these operations only as means of affecting the general system. On the other hand, we obtain topical effects, both powerful and useful, from cupping and leeching; hence these are termed *local*, while the former are denominated *general* bloodlettings. It must, however, be remembered, that constitutional or general effects are also frequently obtained from both cupping and leeching.

1. *Constitutional or general effects of leeching* are the same in kind as those caused by the loss of blood from other means. A moderate quantity of blood may be abstracted without any obvious effects on any of the functions; but, if the amount taken be increased, syncope results. The quantity necessary to produce this varies, however, considerably, and will depend on the mode of drawing it (whether rapidly or otherwise); the position, constitution, and age of the patient; the nature of the disease; and many other circumstances not necessary to enumerate. It is well known that a small quantity will, if taken rapidly, and the patient be in the erect posture, cause this effect; whereas, a considerably larger amount may be abstracted, if taken gradually, and the patient in the recumbent position, without giving rise to it. The usual explanation of this is, that when blood is drawn faster than the vessels can contract, the circulation is temporarily stopped, and fainting ensues. Several reasons, however, lead me to doubt the sufficiency of this explanation. Leeching, then, as being a slower mode of abstracting blood, is less likely to cause syncope than venesection, or even cupping. As the patient recovers from the fainting state, hysterical symptoms sometimes manifest themselves. Throbbing headache, and sleeplessness, are by no means uncommon consequences of the loss of blood. In some cases I have seen febrile excitement, of several hours' duration, brought on by bloodletting.¹

Dr. Marshall Hall² has directed attention to the disorder of the cerebral functions (marked by convulsions, delirium, or coma) caused by bloodletting. I may observe, that convulsive movements are by no means uncommon in syncope from general bloodletting, and I think are not always to be considered as denoting that the remedy has been used beyond the safe degree. I have on several occasions been told by patients about to lose blood, that they are apt to faint and struggle when bled; and I have, in consequence, been requested to prevent them from injuring themselves. Delirium and coma are less frequently met with. Great depression of the vascular system, followed by sudden dissolution, is another occasional effect of loss of blood.³

As might be expected, an operation so powerfully affecting the vital functions cannot be passive in its influence over morbid action; but the phenomena vary so much in different diseases, and even in the same disease under different circumstances, that it becomes extremely difficult to offer any general results. That loss of blood is sometimes beneficial, at other times hurtful, is well known. Its immediate beneficial effects are best seen in pneumonia and ophthalmia. In the first of these diseases the respiration sometimes becomes easier, and the pain removed, while the blood is flowing; and from this time the amendment progresses. In ophthalmia, the redness of the conjunctiva disappears during the syncope from bloodletting, and sometimes never returns with equal intensity. A tendency to hemorrhage has been thought by some experienced practitioners to be engendered or increased by the application of leeches. Thus, the return of the menses, the aggravation of menorrhagia, hæmoptysis, and apoplexy, have been found to follow, and apparently to result from, the employment of leeches.⁴

¹ For farther details respecting the effects of loss of blood, see Dr. Clutterbuck *On the Proper Administration of Bloodletting*, 1840.

² *On the Morbid and Curative Effects of Loss of Blood*, 1830.

³ See an illustrative case in the *Lancet*, vol. xi. p. 94.

⁴ See the observations of Laennec and Sir James Clark, in Forbes's translation of Laennec's *Treatise on Diseases of the Chest*, p. 193, 1827.

The effects of bloodletting are considerably influenced by disease. Every practitioner is acquainted with the fact that in certain morbid conditions patients bear the loss of larger quantities of blood than in others. I need only mention apoplexy, inflammation of the serous membranes, peripneumony, and phrenitis, as examples of increased tolerance; while chlorosis and cholera may be cited as instances of diminished tolerance. On this point there cannot be, I think, two opinions.

I confess I am not prepared to assent to the inferences Dr. Hall has drawn from these facts, nor to the rules he has laid down in the diagnosis and treatment of disease founded on the circumstances just mentioned. The susceptibility to syncope is so great in some persons, that we should, I suspect, be often led into error, if we were to infer the absence of inflammation merely from the occurrence of fainting after the loss of a few ounces of blood. Besides, it not unfrequently happens that a patient faints on the first, but not on the second or third bleeding. I have more than once seen this. Neither do I think it would always be safe to bleed *ad deliquium*, even if we were satisfied that inflammation be present; for in some it is difficult to occasion syncope, although the quantity of blood lost be so great as to endanger the safety of the patient. The practice of Dr. Hall, however, is much to be preferred in this respect to that of Mr. Wardrop;¹ for, although both recommend bleeding to syncope in inflammation, the former places his patient in the erect, the latter in the recumbent posture. And here I cannot help remarking, that the practice of ordering patients to be bled to syncope in the recumbent posture appears to me a highly dangerous one. That fainting will sometimes occur in the erect position, before a sufficient quantity of blood has been drawn, we all know; and, to prevent this occurrence, it is frequently proper to bleed in the recumbent posture; but I must protest against bleeding patients to *syncope* in this position.

I have yet to notice another class of the general effects of the loss of blood, which may be denominated secondary or remote, and which are in no way useful in the treatment of disease. In some cases excessive reaction occurs, attended with throbbing of the vessels of the brain, pain and disorder of the cerebral functions. Examples of this are seen in women who have suffered severely from uterine hemorrhage. Exhaustion, with insufficient reaction, is another remote effect of loss of blood. In two cases of infants, I have seen this effect, consequent on hemorrhage after a leech-bite, terminate fatally. Other secondary or remote effects of bloodletting are mentioned; they consist principally in disorder of the sensorial functions, marked by delirium, coma, or even amaurosis.²

Having hitherto described the consequences of bleeding generally, I must now refer more particularly to leeching. The constitutional or general effects caused by the application of leeches are best observed in children and delicate females—more especially the former. I have, on several occasions, seen infants completely blanched by the application of one or two leeches. Pelletan mentions the case of a child, six years old, who died from the hemorrhage occasioned by six leeches applied to the chest. Leeching, then, is here, to all intents and purposes, a mode of general bloodletting, arising in part from the powerful influence which a small quantity of blood produces in infants; and secondly, because one leech will cause the loss of more blood in them than in adults, owing to the greater vascularity of the cutaneous system. It is apparent, therefore, that in the diseases of infants, leeching may, in most cases, be substituted for venesection. But in disorders which are rapidly fatal, as croup, opening the jugular vein is undoubtedly to be preferred, since it is necessary to produce an immediate and powerful effect. As children advance in years they become capable of bearing larger evacuations of blood; and, therefore, leeching excites a less influential effect. It is quite impossible to say at what age venesection ought to be substituted, or, in infancy, what number of leeches should be applied; since they take away such unequal quantities of blood. These are points

¹ On Bloodletting.

² Dr. M. Hall, *op. supra cit.*

which must be decided by the practitioner in each case. Here is a tabular statement of the amount of blood which Dr. James Blundell¹ has taken from children at different ages:—

Ages.	Quantities.
2 months	1 ounce to 1½ ounces.
4 "	1¼ " to 2 " "
8 "	2 " to 3 " "
12 "	3 " to 4 " "
18 "	4 " to 5 " "
3 years	8 " to 10 " "
6 "	10 " to 12 " "

But these quantities are exceedingly large, and in most instances greater than it will be found prudent to abstract. Guersent says that, in infants up to two years of age, we ought never to draw more than three or four ounces of blood in twenty-four hours.²

2. *The local effects of leeching* must now be noticed. The jaws of the leech may be compared to three saws, each armed with sixty teeth. It is, therefore, not surprising that pain and afflux of blood to the wounded part should be occasioned by the laceration of the skin by a single leech. I have sometimes seen one of these animals produce intense redness to the extent of an inch around the bite. This is best observed when the skin is delicate, as that covering the mammæ of the female. Now when a number of these animals are applied, their united local effects must have some influence over a neighbouring disease. There are also certain topical effects which occur subsequently, such as ecchymosis; the irritation and inflammation of the mouths of the punctures; the diffused redness and the soreness in the parts intervening between the bites, which cannot be without influence over morbid action. They act on the principle of counter-irritation. In taking into consideration the beneficial influence of leeches, we must, therefore, not forget these, nor the fomentations and poultices subsequently employed.

When leeches are applied to the temples, especially if they fix close to the external canthus, a diffused swelling frequently arises, similar to that caused by erysipelas. This is not referable to any noxious qualities of the animal, for it happens when the finest and most healthy are employed; nor to the teeth of the animal being left within the wound, since I have seen it when the leech has fallen off spontaneously.

In concluding these remarks on the local effects of leeches, I have only to add that, independently of the local irritation caused by the puncture, I believe the evacuation of blood from an inflamed part may be more beneficial than the same quantity taken by the usual operation of venesection. In other words, I am disposed to admit what were formerly termed the *derivative* effects of local bleeding. The amount of benefit obtained by the application of leeches to parts that have been injured by falls, &c., as in fractures and dislocations, has frequently appeared to me much greater than could be referred to the combined influence of the quantity of blood lost, and the local irritation of the punctures; so, also, with respect to the good effects of leeching hemorrhoidal tumours. Mr. Wardrop thinks more benefit is in some cases obtained by the application of leeches at a distance from the affected organ, constituting what has been termed a *revulsive* operation.

I trust the remarks now offered will be sufficient to prove that, in estimating the therapeutic influence of leeches, the quantity of blood drawn is not the only element in the calculation; and I think, in practice, constant proof will be found that leeching is more beneficial than can be accounted for by the mere quantity of blood drawn.

USES.—The following are some of the uses of leeches:—

1. *In children and delicate adults (as females and aged persons) leeches often form an excellent substitute for general bloodletting*, when the object is not to occasion

¹ *Lancet*, Sept. 20, 1828, p. 773.

² On the sensible effects of leeches on man, see Vitet, *Traité de la Sangs. Méd.* 1809.

any immediate or sudden effect on the disease. In children, it is necessary to avoid applying them to the neck, or other parts where compression cannot be conveniently made.

2. In *local determinations of blood*, unattended with febrile symptoms, local blood-letting, when it can be resorted to, is generally, though not invariably, preferred to phlebotomy. The advantages of leeching over cupping are, the less pain, and the ease with which blood may be procured; for it is evident that in swelled testicle, in inflammation attending fractured limbs, and in acute inflammation of the mammary gland, patients could not, in most cases, bear the necessary pressure of the cupping-glass; and in some parts of the body, as the abdomen, blood can only be procured from cupping by a very dexterous manipulation.

3. In internal and other inflammatory affections, accompanied with constitutional disorder, the rule is to employ general in preference to local bloodletting. But circumstances occasionally render the reverse practice justifiable and proper, as where the disease is not active, and the patient delicate and weak. In many instances it will be found most advantageous to combine both modes of drawing blood; for example, in *abdominal inflammations*, the application of leeches, preceded by venesection, will sometimes do more good than the same quantity taken by the lancet alone. During the progress of *fever* with determination of blood to the brain, the application of leeches to the temples, after the use of bloodletting, is often attended with the best effects.

4. There are some diseases in which no substitute of equal efficacy can be found for leeches. Such, I conceive, are *hemorrhoidal tumours*, and *prolapsus of the rectum*. In these cases, general is not equal to local bloodletting, and cupping is out of the question.

5. In *various organic diseases* leeches will often be found an exceedingly useful palliative means. I would particularly mention, as examples, affections of the heart and lungs.

6. Dr. Crampton¹ recommends the application of leeches to the internal surfaces; as to the conjunctiva in ophthalmia, to the tonsils in cynanche tonsillaris, and to the internal surface of the nostrils in epistaxis. The mode of applying a leech to the tonsils is as follows: pass a single thread of silk through the body of the leech, and make fast the ligature to the finger of the operator; then apply the leech to the part.

There are few diseases in which loss of blood is required, where leeching is positively objectionable; indeed, erysipelas is the only one that can be named. Here it has been supposed that the local irritation caused by leeches would add to the severity of the malady; but I believe that, even in this case, the objections are more imaginary than real. There are, however, numerous instances in which leeching is negatively objectionable; in some, the quantity of blood drawn by these animals is insufficient to make much impression on the disease, as in visceral inflammation of robust persons; in others, where the disease is very rapid and fatal, the effects of leeches are too slow, as in croup. Venesection is the remedy in all these instances.²

MODE OF APPLYING LEECHES.—Let the part be well cleansed (sometimes it may be necessary to shave it); then dry the leeches, by rolling them in a clean linen cloth; place them in the lid of a pill-box, and apply to the affected part. This is a preferable method to applying them by the fingers, or in a wineglass. A narrow tube (called a *leech-glass*) will be found useful when we wish to affix one of these animals to the inside of the mouth, or any particular spot. [By grasping the body of the leech gently in a dry cloth, its head may be directed to any part where we wish it to be applied; and by gently withdrawing it as its head reaches the skin, we compel the animal to fix its head to the spot, and insert its teeth.—ED.]

¹ *Dublin Hospital Reports*, vol. iii. 1822.

² For a more extended account of the uses of leeching, see Dr. R. Price, *Treatise on the Utility of Sanguisuction*, 1822.

Several circumstances influence the fixing of leeches; as the condition of the animal, whether healthy or otherwise; the nature and condition of the part to which it is applied: thus, leeches will not readily attach themselves to the soles of the feet, or the palms of the hands, or to the hairy parts—the presence of grease, vinegar, salt, and some other substances, will prevent them from biting; whereas, milk, sugared water, and blood, are said to have the contrary effect. Scarifying the part promotes their attachment. The condition of the patient also affects the fixing of the animal. Derheims¹ says that leeches will not bite those under the influence of sulphur, on account of the evolution of sulphuretted hydrogen by the skin. The effluvia or vapours of the room, as the fumes of tobacco, sulphur, vinegar, &c., will prevent them biting, or even cause them suddenly to fall off.

The quantity of blood a leech is capable of drawing varies considerably. I believe four drachms to be the maximum. On an average, I do not think we ought to estimate it at more than one drachm and a half. Of course this has no reference to that lost after the animal has fallen off; and which varies according to the vascularity of the part; in children being oftentimes very considerable. When the leech has had sufficient it drops off; but it is said that if the tail be snipped the animal will continue to bite, the blood passing out posteriorly as fast as it is taken in by the mouth. I have tried several, but they usually let go their hold the instant the tail is cut. H. Cloquet² has made the same remark. In order to disgorge the leech of the blood, the usual practice is to apply salt to its body; but it is objectionable (if you wish to preserve the animal), since the surface is frequently thereby blistered, and several days elapse ere the creature regains its former activity. Some advise squeezing the blood out by the mouth; others, the application of diluted vinegar to the head. If no kind of emetic be employed, the blood remains for a considerable time in the stomach of the leech undigested, but without putrefying.

AFTER-TREATMENT.—When leeches have fallen off, it is generally desirable to promote the sanguineous discharge. This is best done by the use of warm fomentations or cataplasms; or even, in some cases, by cupping-glasses. Great caution is necessary in the case of children. Some years since, the application of a leech was ordered to the chest of a child labouring under pneumonia; it was at the same time mentioned that the bleeding should be encouraged. The directions were literally fulfilled—the discharge of blood was assiduously promoted—until so large a quantity had been lost that death was the result. No attempt was made to stop it, nor notice sent to the Dispensary, in the practice of which the case occurred. The child being illegitimate, and the mother evidently careless of its recovery, led some to suspect that this did not take place through mere ignorance. In another instance two leeches were ordered for a child aged about eighteen months, suffering with pneumonic inflammation, a consequence of measles. The following day the poor little creature was found in a fainting, or rather dying state, with face and lips completely blanched. On inquiry, it appeared the leech-bites were still bleeding, and no attempt had been made to stop the discharge, the mother thinking it would be beneficial, more especially as the pneumonic symptoms had considerably abated. As predicted, the little sufferer died within twenty-four hours.

In some persons, there appears to be an hereditary predisposition to hemorrhage, so that very slight wounds are attended with serious and even fatal effects. Mr. Wilson, quoted by Mr. Wardrop,³ has related the case of a child where one leech had nearly caused death, by the serious hemorrhage. When about three or four years old, this child bit its tongue, and, notwithstanding that every attempt was made to stop the discharge, death took place from the loss of blood.

I have been called to many cases of hemorrhage after leech bites, and have never failed in stopping it by compression. Sometimes mere exposure to the air will be suf-

¹ *Hist. Nat. et Méd. des Sangs.* p. 134, 1825.

² *Op. supra cit.* p. 13.

³ *Dict. de Médec. art. Sangsue,* p. 83.

ficient; or, if this fail, we may apply a dossil of lint and a bandage. In other instances, this will not succeed. I usually employ compression, thus: roll a piece of lint into a fine cone, and introduce it into the bites by means of a needle or probe; over this lay a compress and bandage. Sponge may be substituted for the lint. Various other modes have been proposed; some, I think, exceedingly cruel, since I do not believe them ever necessary. I allude, now, to the application of a red-hot needle; and to passing a needle through the orifice, and wrapping thread round, just as a farrier stops the discharge of blood from the vein of a horse. Some employ absorbing powders, as gum arabic; or styptic washes, as a saturated solution of alum. One very effectual means is to apply a stick of lunar caustic scraped to a point, or powdered nitrate of silver. Sir Charles Bell, in one case, stitched up the wound.

ACCIDENTS FROM LEECHES IN THE MUCOUS CAVITIES.—The ancients were very apprehensive of the ill consequences likely to arise from swallowing leeches. That their fears were not groundless is proved from the following circumstances, related by the celebrated Baron Larrey. When the French army entered upon the deserts which separate Egypt from Syria, the soldiers, pressed by thirst, threw themselves on their faces, and drank greedily of the muddy water, and which, unknown to them, contained leeches (*Sanguisuga ægyptiaca*), having the form of a horse-hair, and the length of a few lines only. Many of them felt immediately stings, or pricking pains, in the posterior fauces, followed by frequent coughs, glairy spots, slightly tinged with blood, and a disposition to vomit, with a difficulty of swallowing, laborious respiration, and sharp pains in the chest, loss of appetite and rest, attended with great uneasiness and agitation. On pressing down the tongue of the individual first attacked, a leech was discovered, which was with difficulty removed by the forceps. Little or no hemorrhage followed, and the patient recovered. Those which had attached themselves to the posterior fauces were removed by the use of gargles composed of vinegar and salt water. The Chief of Brigade, Latour-Maubert, commander of the 22d regiment of chasseurs, swallowed two in the deserts of St. Makaire, a day's journey from the Pyramids, which so much weakened him, that his convalescence was long and difficult.

Derheims¹ relates a case where a young man, who had leeches applied to his anus, was so unfortunate as to have one enter his rectum unnoticed. The animal made several punctures, and was not expelled until some hours after, when salt-water injections were used. The wounds caused by the bites, however, did not heal for several months, during which time the patient suffered considerably, and constantly passed blood with the feces.

Whenever practicable, salt-water injections should be resorted to. In the following cases related by Derheims² this practice could not be adopted. Two small leeches were applied to the gums of an infant during the period of dentition, and by the inattention of the nurse they fixed themselves at the back part of the mouth, and, becoming gorged with blood, caused great difficulty of respiration. The infant, by strongly closing the jaws, prevented the removal of the animals, who only ceased their hold when they were filled with blood. The hemorrhage continued for two hours.

Ill effects have resulted from swallowing leeches. A lady accidentally swallowed a leech she was applying to her gums. Acute cardialgia soon came on, with a feeling of erosion and creeping in the interior of the stomach; sometimes convulsive movements in the limbs and muscles of the face; frequency and irregularity of the pulse; universal agitation and paleness of the countenance. The physician who was called in, recollecting the fact ascertained by Bibiéna, that leeches could not live in wine, administered half a glass every quarter of an hour. The symptoms were soon alleviated; and the fourth dose caused vomiting, by which the dead leech

¹ *Op. supra cit.* p. 140.

² Page 140.

was evacuated, with much glairy matter, mixed with clots of black blood. By a proper subsequent treatment, the patient recovered in eight days¹

[The following case occurred within our knowledge: A lady was directed to apply a leech to the septum of the nose. By some accident the animal insinuated itself into the nasal cavities, and, reaching the posterior nares, the patient was irresistibly compelled to swallow it. No uneasiness was felt, probably owing to the leech having already drawn much blood. A moderately strong solution of chloride of sodium was administered at short intervals. The leech was not discharged by vomiting, and it did not pass by the bowels. The patient suffered from no unusual symptoms, probably owing to the rapid administration of the solution of salt.—Ed.]

Class VI. Insecta, Goldfuss.—Insects.

CHARACTERS.—Articulated animals with 6 feet (*hexapoda*), one pair of *antennæ*, a dorsal vessel for circulation, respiring by *tracheæ*, and undergoing *metamorphosis* (being successively *ovum*, *larva*, *pupa*, and *imago*). *Head* distinct from the thorax.

ORDER I. COLEOPTERA, *Linncæus*.—BEETLES.

CHARACTERS.—4 *wings*, of which the two upper or anterior *elytra* or (*wing cases*) are horny or leathery, united down the back by a straight suture; lower or posterior wings folded longitudinally. *Mandibles* and *jaws* for mastication.

354. CANTHARIS VESICATORIA, *Latreille, L. E. D.*—THE BLISTER BEETLE, OR SPANISH FLY.

Lytta vesicatoria, Fabricius; Meloë vesicatorius, Linnæus.

(The whole fly. *E.*—*Cantharis, U. S.*)

HISTORY.—Hippocrates employed in medicine an insect which he calls *καυθαρίς*, whose effects were similar to those of our *Cantharis vesicatoria*. Hence, it has been erroneously inferred by some writers that our blistering beetle is identical with that employed by the ancients. That this inference is incorrect is proved by the following facts. In the first place, many beetles agree in their effects on the system with those of *Cantharis vesicatoria*; secondly, the word *καυθαρίς* merely signifies a *small beetle* or *scarabæus parvus*; thirdly, both Dioscorides² and Pliny³ refer to several kinds of *cantharides*, but remark that the most powerful are those with transverse yellow bands on the wings, and that those which are homogeneous in colour are weak and inert. It is tolerably clear, therefore, that neither of these ancient writers was acquainted with *Cantharis vesicatoria*. Now the characters assigned to the ancient blistering insect agree precisely with those of two species of *Mylabris*. Burmeister⁴ suggests that *Mylabris Füsselini*, a native of the south of Europe, was the species used by the ancients. *Mylabris Cichorii* is employed as a blistering beetle at the present day in China and some parts of Hindostan, and may, perhaps, have been used by the Greeks and Romans.

ZOOLOGY. Gen. Char.—*Antennæ* elongate, simple, filiform. *Maxillary palpi* with terminal joint somewhat ovate. *Head* large, heart-shaped. *Thorax* small, rather quadrate, narrower than the elytra, which are as long as the abdomen, soft, linear, the apex slightly gaping. *Wings* two, ample (J. F. Stephens).⁵

Sp. Char.—Bright glossy brass-green or bluish, glabrous; beneath more glossy, with a few hairs. *Breast* densely pubescent, finely punctured. *Head* and *thorax* with a longitudinal channel. *Elytra* with two slightly raised lines. *Tarsi* violaceous. *Antennæ* black, with the basal joint brassy (J. F. Stephens).

¹ *Recueil périodique.*

² *Hist. Nat. lib. xxix. cap. 30, ed. Valp.*

³ *Man. of Brit. Coleopt. p. 334, 1839.*

² *Lib. ii. cap. 65.*

⁴ *Man. of Entomol. by Shuckard, p. 562, 1836.*

⁵ *Man. of Entomol. by Shuckard, p. 562, 1836.*

Form elongated, almost cylindrical. *Length* six to eleven lines. *Breadth* one to two lines. *Colour* brass or copper green. *Odour* nauseous, unpleasant. *Body* covered with whitish-gray hairs, which are most numerous on the thorax. *Head* large, subcordate, with a longitudinal furrow along its top. *Eyes* lateral, dark brown. *Thorax* not larger than the head, narrowed at the base. *Elytra* from four to six lines long, and from 3-4ths to 1½ lines broad; costa slightly margined. *Wings* ample, thin, membranous, veined, transparent, pale brown; tips folded. *Legs* stout, from four to six lines long, the hinder ones longest; *tibiæ* clavate, in the female all terminated by two small movable *spurs*; in the male, the two hinder pairs of extremities alone have this arrangement, the anterior ones having but one spur; last joint of the *tarsi* with a pair of bifid claws. *Abdomen* soft, broadest in the female. In the female, near the anus, are two articulated, caudal appendages.

Fig. 426.



Cantharides.

The *internal organization* of these animals has been elaborately studied by Andouin¹ and by Brandt². The **NERVOUS SYSTEM** consists of a cerebro spinal axis, and a double and single sympathetic system. The *cerebro-spinal axis* consists of a double nervous cord, and nine ganglia (two cephalic, one of which is the brain, three thoracic, and four abdominal). The *single sympathetic system* commences at the brain by two branches, which unite at the ganglion frontale, from which a single nerve proceeds along the œsophagus to the stomach, where it divides into two, forming at its division a small ganglion. The *double sympathetic system* consists of four ganglia placed on the œsophagus, two on either side of the single nervous cord just described,

with which, as well as with the brain, they are connected by nervous twigs. The **VASCULAR SYSTEM** consists of a *simple pulsating dorsal vessel*, which extends from the head to the extremity of the abdomen. The **RESPIRATORY SYSTEM** consists of ten pair (three thoracic, seven abdominal) of stigmata, which open into the tracheæ. The **DIGESTIVE SYSTEM** consists of the *mouth*, which terminates in the *pharynx*. The latter contracts into a long muscular *œsophagus*, which ends in an elongated fusiform *stomach*. The latter is marked transversely by bands formed by the

Fig. 427.

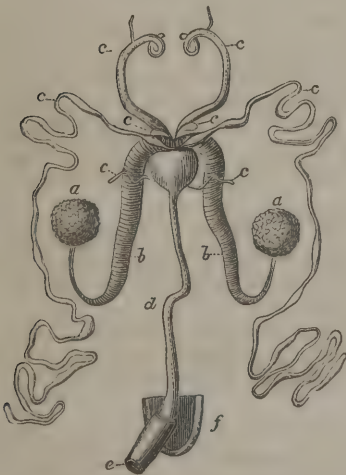
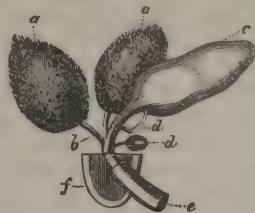
Male Genital Organs of *Cantharis vesicatoria*.

Fig. 428.

Female Organs of *Cantharis vesicatoria*.

- a a. Testicle.
 b b. Vasa deferentia.
 c c, c c, c c, c c. The four pair of vesiculæ seminales, or epididymoid vessels.
 d. The common spermatic tube.
 e. Portion of the intestinal tube inverted.
 f. Last abdominal ring.

- a a. The ovaries covered by the egg tubes; each ovary sends out an oviduct, b. The two ducts unite to form the common oviduct, which receives the excretory tube of the *spermatheca*, c, and of other appendages, d d.
 e. Portion of the inverted intestine.
 f. Last abdominal ring.

¹ Ann. des Scienc. Nat. t. ix. p. 31.² Med. Zool. ii.

muscular coat. Between the stomach and intestine is a *valve* (pylorus) formed by four small floating, kidney-shaped bodies. The *small intestine* forms two curvatures, and then proceeding directly backwards, terminates in the swollen *cæcum*, which ends in the very short narrow *rectum*. The *biliary vessels* consist of six very long, filiform, convoluted tubes, which terminate anteriorly at the stomach near the pylorus, and posteriorly at the intestine near the *cæcum*. THE SEXUAL SYSTEM of the MALE consists of a pair of spherical *testicles*, having externally a granulated appearance; two *vasa deferentia*, which have a ringed appearance; three or four pairs of tubes (*seminal vesicles* or *epididymoid vessels*), the functions of which are imperfectly known; a *common spermatic duct*; and a *penis*, which has three barbs or *hooks* at its extremity, and is enveloped by a *sheath*. THE FEMALE ORGANS consist of two large, hollow, egg-shaped *ovaries*, the cavities of which are called *calyces*. On their external surface is an immense number of pyriform *egg-tubes*. From each ovary or calyx arises an *oviduct*, and the two oviducts by their junction form the *common oviduct*, the lower portion of which is called the *vagina*. Into the common oviduct passes a *tube* from a vascular bag, called *spermatheca* (*vesicule copulatrice*, Audouin), and also from other *appendages* (*sebaceous glands*, Audouin).

I must refer to Audouin's paper for an amusing account of the amours of these animals.

Hab.—Europe. Originally, perhaps, a native of the southern parts, especially Italy and Spain. Now found in France, Germany, Hungary, Russia, Siberia, and England. With us they are rare. In the summer of 1837, they were abundant in Essex and Suffolk.¹ They are found on species of *Oleaceæ* (as the ash, privet, and lilac), and of *Caprifoliaceæ* (as the elder and *Lonicera*).

MODE OF CATCHING CANTHARIDES.—In the south of France these animals are caught during the month of May, either in the morning or evening, when they are less active, by spreading large cloths under the trees, which are then strongly shaken or beaten with long poles. The catchers usually cover their faces, and guard their hands by gloves.² Various methods have been recommended for killing the insects; such as exposing them to the vapour of vinegar (the practice mentioned by Dioscorides), or of hot water, or of spirit of wine, or of the oil of turpentine. Geiger states that, if destroyed by dropping oil of turpentine into the bottle in which they are contained, they are not subject to the attack of mites; but I believe they are more frequently destroyed by immersing the cloths containing them in hot vinegar and water, and then drying on hurdles covered with paper or cloths.

PRESERVATION.—Cantharides should be preserved in well-stoppered bottles, and to prevent them from being attacked by mites (*Acarus domesticus*), a few drops of strong acetic acid should be added to them. I have found this a most successful mode of preservation. (Besides mites, they are subject to the attacks of a moth (*Tinea flavifrontella*), and two coleopterous insects (*Anthrenus muscorum* and *Hoplia furinosa*).

COMMERCE.—Cantharides are imported from St. Petersburg, in cases, each containing 160 or 170 lbs.; and also from Messina, in barrels or cases, holding each about 100 lbs. They are principally brought over towards the end of the year. In 1839, duty (1s. per lb.) was paid on 16,376 lbs.

The cantharides from St. Petersburg are the largest and most esteemed. They are somewhat more copper-coloured than the French or English varieties, which have rather a brassy than copper tint. Sir James Wyllie³ states that they are very abundant in the southern provinces of Russia.

CHARACTERISTICS FOR MEDICO-LEGAL PURPOSES.—There are no *chemical tests* for cantharides, to be relied on. Orfila⁴ has published an account of the effects of various reagents on tincture of cantharides; but they are unimportant. Cantharides are rarely met with in a sufficiently perfect form to enable us to recognize them by their *zoological characters*. Their *physical characters* are much more important. In all powders of cantharides golden green particles may be distinguished; these may be separated from the other contents of the stomach by immersing them in boiling water; the fatty matter rises to the surface, while the cantharides powder falls to the bottom. Orfila has recognized these particles in a body nine months

¹ Westwood, *Intr. to the Mod. Classif. of Insects*, vol. i. 1839.

² *Pharmacopœia Astrensis Ruthenica*, p. 243, Petropoli, 1840.

³ Richard, *Dict. des Drog.* i. 550.

⁴ *Toxicol. Gén.*

after interment; so that they do not readily decompose, even when mixed with decaying animal matters. [A portion of the suspected substance spread in a thin layer should be allowed to dry on a piece of glass. When dried, either by the naked eye or by the aid of a lens, the green and copper-coloured particles of the wings may be seen, if cantharides be present, on one or both sides of the glass.—ED.] Some other insects, however, have the same golden-green colour, but are without vesicating properties; and *vice versa*, there are many insects which vesicate, but which have not a golden-green colour. The physical characters of the particles, aided by their *physiological effects*, together form tolerably conclusive evidence of the presence of cantharides. To judge of the effects of cantharides, and their preparations, we should proceed as follows: If the suspected matter be a liquid, evaporate it to the consistence of an extract; then digest in repeated quantities of sulphuric ether. The ethereal solutions are to be mixed, and allowed to evaporate in the air; the vesicating properties of the residuum may be determined by applying it to the inside of the lip or to the arm. If the suspected matter contain solid particles, these are to be digested in ether, and the concentrated tincture applied to the inner surface of the lip.¹ Dr. Hastings² has published an interesting fatal case of inflammation of the alimentary canal and urinary organs. The symptoms simulated those caused by excessive doses of cantharides; but the moral and other evidence seemed to negative the suspicion that insects had been taken.

ADULTERATION AND GOODNESS.—The goodness or quality of cantharides may be recognized by their odour, and freedom from other insects, especially mites. Sometimes the powder, but more commonly the plaster, is adulterated with powdered euphorbium. I have been informed, by persons well acquainted with the fact, that it is a common practice, amongst certain druggists, to mix one pound of euphorbium with fourteen pounds of powdered Spanish flies.

COMPOSITION.—Cantharides were analyzed in 1803 by Thouvenal,³ in 1804 by Beaulpoil,⁴ and in 1810 by Roubiquet.⁵

Thouvenal's Analysis.	Beaulpoil's Analysis.	Roubiquet's Analysis.
Watery extract . . . 37.50	Black matter, insoluble in alcohol, but soluble in water 12.94	1. Cantharidin.
Subsequent alcoholic extract 10.42	Yellow matter, soluble in water, alcohol, and ether 12.94	2. Green fatty oil, soluble in alcohol.
Subsequent ethereal extract 2.08	Green oil, soluble in alcohol and ether 13.99	3. Fatty matter, insoluble in alcohol.
Insoluble residuum . . 50.00	Parenchyma, salts, and oxide of iron 60.13	4. Yellow viscid substance, soluble in water and alcohol (osmazome?).
Total 100.00	Phosphoric acid ?	5. Black matter, soluble in water, insoluble in alcohol.
	Total 100.00	6. Yellow matter, soluble in ether and alcohol.
		7. Free acetic and uric acids.
		8. Phosphate of lime, and phosphate of magnesia.
		Cantharis vesicatoria.

1. **CANTHARIDIN** (*Vesicatorin*; *Cantharides-Camphor*).—Has been found in *Cantharides vesicatoria*, *Lytta vittata*, *Mylabris Cichorii*, and other vesicating insects. Probably exists in all the blistering beetles. To procure it, concentrate an alcoholic tincture (prepared by percolation) and set aside; the cantharadin slowly crystallizes. It is purified by washing with cold alcohol, and boiling with alcohol and animal charcoal. Its properties are as follows: It crystallizes in the form of micaceous plates, which are fusible, forming a yellow oil, which by a stronger heat is vaporizable, forming white vapours; these subsequently condense into acicular crystals of cantharidin. Dana regards it as an organic alkali, but without any just grounds; for it will not restore the blue colour of litmus paper reddened by an acid. Gmelin's opinion, that it is a solid volatile oil, seems to be correct. When isolated, it is not soluble in water, but becomes so by combination with the other constituents of cantharides; the yellow matter probably being the principal agent in rendering it so. This, then, is the reason why an aqueous infusion of the insects contains cantharidin in solution. Cold spirit, digested on cantharides, extracts cantharidin; which it can only do by the agency of some of the other principles of the flies. It is easily soluble in ether, oils (volatile and fixed), and hot spirit of wine; and from the latter it separates as the liquid cools. Concentrated boiling sulphuric acid dissolves cantharidin; the

¹ See *Ann. d'Hygiène Publique*, 1835, xiii. p. 455.

² *Trans. of the Provin. Med. and Surg. Assoc.* vol. i. p. 402.

³ *Ann. de Chim.* xlvii. 230.

⁴ *Ibid.* lxxvi. 302.

⁵ *Ibid.* xlviii. 29.

solution is slightly brown; when diluted with water it deposits small needle-like crystals of cantharidin. Boiling nitric and hydrochloric acids dissolve it without changing colour; the solutions, by cooling, deposit it. Cantharidin is dissolved by potash and soda; but when concentrated acetic acid is added to the solution, the cantharidin is precipitated. Ammonia is without action on it. According to Regnaud, it consists of carbon 61.68; hydrogen 6.04; and oxygen 32.28.

Robiquet thus describes the effects of cantharidin: The 1-100th part of a grain, placed on a slip of paper and applied to the edge of the lower lip, caused, in about a quarter of an hour, small blisters. A little cerate being applied, served only to extend the action over a larger surface, and both lips were in consequence covered with blisters. Some atoms of cantharidin, dissolved in two or three drops of almond oil, were rubbed over a small piece of paper, and applied to the arm; in six hours the blister was formed, the size of the paper. The volatility of cantharidin at a comparatively low temperature, and the action of the vapour on the conjunctival membrane, are shown by the accident which happened to one of Robiquet's pupils, who was watching its crystallization, and felt acute pain in the conjunctiva, which was followed by inflammation, accompanied with small phlyctenæ, and loss of sight for several days. Robiquet, who was not so near the liquid, suffered but slightly. I have suffered once in preparing this substance. I applied one drop of an ethereal solution of impure cantharidin to the inside of the lower lip; but immediately afterwards, repenting of my temerity, I wiped it carefully off. In about an hour a blister had formed on the inside of the lip, and it was five or six days before the part had completely healed. Bretonneau, in his experiments on animals, has not found any marked aphrodisiac effect produced by cantharidin. He found that it rendered the circulation slower, and caused fatal lethargy.

2. **VOLATILE ODOROUS OIL?**—Orfila asserts that volatile odorous oil is one of the constituents of the insects. The distilled water of cantharides is strongly odorous and milky; and its vapour affects the eyes and kidneys like cantharides.

The active and odorous principles of cantharides reside principally in the sexual organs of the animals. Both Farines and Zier tell us, that the soft contain more active matter than the hard parts. It appears, also, that the posterior is much more acrid than the anterior portion of the body; and Zier says the ovaries are particularly rich in this active matter. If so, it is evident that we ought to prefer large female to male insects. It is a well-known fact, that the odour of these animals becomes much more powerful at the season of copulation than at other periods; and that persons sitting under the trees in which these insects are found, at this season more particularly, are very apt to be attacked with ophthalmia and ardor urinæ.

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—The principal experiments with cantharides on animals (dogs) are those of Orfila¹ and Schubarth.² It results from their investigations, that these insects cause violent inflammation in the parts to which they are applied, and an affection of the nervous system (spinal cord, principally). Injected into the jugular vein, the oleaginous infusion caused tetanus; introduced into the stomach, the œsophagus being tied, the tincture produced insensibility (Orfila). Inflammation of the inner coat of the bladder was observed when the poison had remained in the stomach for a few hours before death.

β. On Man.—The typical effects of cantharides are those of a most powerful acrid. When these insects are applied to the skin, the first effects noticed are, a sensation of heat accompanied by pain, redness, and slight swelling. These phenomena are soon followed by a serous effusion between the corium and epidermis, by which the latter is raised, forming what is commonly termed a *blister*, or, in the more precise language of the cutaneous pathologist, an *ampulla* or *bulla*. The effused liquid has a pale-yellow colour, with a very feeble taste and smell. Two analyses of it have been made:—

Analysis by Dr. Bostock.		Analysis by Brandes and Reimann.	
Albumen	6.00	Albumen	5.75
Uncoagulable matter	0.14	Animal matter, with muriate of ammonia, potash salts, carbonate, lactate, muriate, and sulphate of soda	0.26
Salts	1.00	Water	93.99
Water	92.86		
	100.00		100.00

If the cuticle be removed, the subjacent corium is seen intensely reddened, and, by exposure to the air, oftentimes becomes exceedingly painful. If irritants be applied, a secretion of pus takes place, and sometimes a whitish-looking false mem-

¹ *Toxicol. Gén.*

² Wilmmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 262.

brane is formed. Long-continued irritation occasionally causes tubercular granulations. Not unfrequently I have noticed ecchymatous pustules around the blistered surface; and in one remarkable case, which fell under my notice, the whole body, but more especially the pectoral region (to which the blister had been applied), was covered with them. Sometimes the vesicles of eczema occur. Ulceration and gangrene are not uncommon; the latter effect is occasionally observed after exanthematous diseases, especially measles. I have seen death result therefrom in two instances. The constitutional symptoms frequently produced are excitement of the vascular system (as denoted by the increased frequency of pulse, heat of skin, and furred tongue), and irritation of the urinary and genital organs (marked by heat and pain in passing the urine, which is usually high coloured, or there may be complete suppression). It not unfrequently happens that the part to which a blister has been applied remains considerably darker coloured than the surrounding skin. Rayer states that the disappearance of these discolorations is hastened by the use of sulphurous baths.

When swallowed, cantharides act topically on the *gastro-intestinal membrane*; in poisonous quantities they excite inflammation of the mucous lining of the alimentary canal, with constriction and difficulty of swallowing, which is sometimes so great, that not a particle of fluid can be got into the stomach without the most inexpressible anguish; violent burning pain, nausea, vomiting, frequently of bloody matters, sometimes with flakes like the inner lining of the alimentary tube, and great tenderness to touch. These phenomena sufficiently indicate the gastric inflammation. Ptyalism is not an uncommon occurrence. The enteritic symptoms are, abundant and frequent evacuations, sometimes of blood, with horrible griping and burning pain, and exquisite sensibility of the abdomen.

The *volatile odorous matter* evolved by these insects is a local irritant; for it causes itching and even inflammation of the eyelids and conjunctiva, irritation of the air-passages, marked by epistaxis, convulsive sneezing, &c. If it be inhaled, as is done when persons sit under trees on which the animals are found, or by breathing the vapour of decoction of cantharides, an affection of the urinary organs may be brought on. The same remote effects may also be excited by blisters, by handling the insects, by applying them to wounds, by swallowing them, or by injecting solutions of their active principle into the veins. We may classify the *remote effects* of cantharides into those observed in the urino-genital, the nervous, and the vascular systems.

aa. Action on the Urino-genital System.—The pain in the loins, and the alteration in the quantity and quality of the urine, are the symptoms indicative of the inflamed condition of the kidneys. The burning pain and tenderness in the hypogastric region, and the constant desire to pass the urine, with the inability of doing so except drop by drop, are evidences of the vesical inflammation. The action on the genital organs in the male is proved by priapism, which is sometimes accompanied by satyriasis, sometimes not; and by the occasional inflammation and mortification of the external organs. In the female, the action on the sexual system is shown by the local heat and irritation, and by the occasional occurrence of abortion.

bb. Action on the Nervous System.—The affection of this system is proved by the pain in the head, disordered intellect, manifested in the form of furious or phrenitic delirium, convulsions of the tetanic kind, and subsequently coma. It is deserving of especial notice, that sometimes several days elapse before the nervous symptoms show themselves: thus, in a case related by Giulio, they appeared on the third day; in another instance, mentioned by Graaf, on the eighth; and in a case noticed by Dr. Ives, they were not observed until the fourteenth day.¹

cc. Action on the Vascular System.—The pulse becomes hard and frequent, the skin hot, and the respiration quickened; diaphoresis is occasionally observed.

The susceptibility to the influence of cantharides is by no means uniform. Werl-

¹ See Christison, *Treatise on Poisons*.

hoff mentions the case of a lad who used to be attacked with priapism and involuntary emission by merely smelling the powder. Amoreux says, in one case a pinch of the powder caused death; while in another a spoonful occasioned only slight heat in the throat, and ardor urinæ. Dr. Hosack has mentioned an instance in which a man took nearly six ounces of the tincture with the view of self-destruction, yet no dangerous symptoms followed. In contrast with this, I may instance a case that came within my own knowledge, where one ounce of the tincture produced serious symptoms. Orfila has seen twenty-four grains of the powder prove fatal.

1. *Action in small or medicinal doses.*—In very small quantities there are no obvious effects. If we increase the dose, a sensation of warmth is felt in the throat, stomach, and respiratory passages, with increased secretion from the alimentary tube. By continued use, a tickling or burning sensation is experienced in the urethra, with frequent desire to pass the urine, which may or may not be altered in quality and quantity. In some cases diuresis is observed, in others not; in the latter the urine is generally higher coloured than usual. Occasionally the sexual feelings are excited.

2. *Action in larger doses; Subacute Poisoning.*—The symptoms are heat in the throat, stomach, intestines, and respiratory passages; pain in the loins, burning sensation in the bladder, with frequent desire to evacuate the urine, which is sometimes bloody, and passed with difficulty. Painful priapism, with or without satyriasis. Pulse more frequent, skin hot, and the respiration quickened; the nervous system is frequently excited.

3. *Action in still larger doses; Acute Poisoning.*—The symptoms observed are, in part, common to other irritant poisons; in part peculiar to the vesicating insects. Violent burning in the stomach, with exquisite sensibility and constant vomiting; extreme thirst, dryness, and fetid odour of the mouth, and not unfrequently ptialism. Burning pain and spasmodic contraction of the bladder, giving rise to the most excruciating agony. Notwithstanding the incessant desire to void urine, nothing but drops of blood are passed, and with great pain. The constriction of the throat and difficulty of deglutition are most distressing and alarming; the unfortunate sufferer is constantly tormented with violent gripings, purging, generally of blood, extreme tenderness of the whole abdominal surface, faintings, giddiness, convulsions, and an almost hydrophobic aversion to liquids, with delirium terminating in coma.

The mode and immediate cause of death are various; sometimes the nervous symptoms kill before gangrene makes its appearance; but more usually the patient dies from inflammation and subsequent mortification of the alimentary tube or of the genital organs.

POST-MORTEM APPEARANCES.—On opening the bodies of persons poisoned by cantharides, inflammation and its consequences have been observed in the alimentary tube, and the urinary and genital organs. The cerebral vessels have been found in a congested state. It is deserving of notice that inflammation of the urino-genital organs is more likely to be met with in patients dying within a few days after poisoning.

USES.—Hippocrates used vesicating insects (under the name of cantharides) internally; but the practice was subsequently regarded as dangerous; and, so lately as the year 1693, the President of the College of Physicians committed Dr. Groenvelt to Newgate for daring to employ them!!¹

1. *Local Uses.*—Cantharides are frequently used as topical agents; sometimes as stimulants, sometimes as rubefacients, at other times as vesicants.

a. *To stimulate topically.*—Tincture of cantharides with water (in the proportion of three or four drachms of the tincture to a pint of water) has been employed to stimulate ulcers; more especially sinuses and fistulous sores. It is said, on the same principle that stimulant and irritant applications are made to the eye in oph-

¹ Groenvelt, *De tuto Cantharidum in medicinâ usu interno*, 12mo. Lond. 1695; Greenfield, *Treatise on Cantharides*, translated by Martin, 1706.

thalamia; that is, to excite a new action, which shall supersede the old one. Matthew's once celebrated injection for fistula *in ano* is a wash of this kind.¹ In *alopecia* or *baldness*, when this is not the result of old age, unguents of cantharides have been employed to promote the growth of hair. Powdered cantharides have been advised as an application to the parts bitten by rabid animals.

β. *To produce Rubefaction*.—For this purpose the tincture may be mixed with soap or camphor liniment; or when it is desirable to limit the effect to a particular spot, and especially if friction be objectionable, the common blistering plaster may be applied, allowing it to remain in contact with the part for an hour or two only. Rubefacient liniments are employed to excite the sensibility of the skin in numbness and paralysis; as also to promote local irritation in neuralgic and rheumatic pains. In the inflammatory affections of children it will be occasionally found useful to employ the plaster as a rubefacient merely.

γ. *To excite Vesication*.—A considerable number of substances (mineral, vegetable, and animal) cause vesication when applied to the skin. Horseradish, meze-reon, liquor ammoniæ, and acetic acid, may be mentioned as examples. To these may be added heat, applied in the form of hot water, or a hot metallic plate. For facility of application, certainty of effect, and slowness of pain, no agents are equal to cantharides, and these are now almost solely used.

It was formerly supposed that the efficacy of blisters was in proportion to the quantity of fluid discharged. But the truth is, that the therapeutic influence is in proportion to the local irritation, and has no more relation to the quantity of fluid discharged than that the latter is frequently (not invariably) in the ratio of the former. Stoll's axiom is, therefore, correct: "Non suppuratio sed stimulus proddest." As to the precise manner in which blisters, or, indeed, any remedies, influence diseases, we are quite in the dark. We are accustomed to refer their operation to the principles of counter-irritation. I must refer those who feel interested in the question whether blisters ought to be applied in the neighbourhood of, or at a distance from, the affected part, to a paper by Barthez, in the *Recueil de la Société Médicale de Paris*. In this country, we generally apply them near to the morbid part; to which practice Barthez assents, with some exceptions.

We employ blisters in inflammatory diseases, both acute and chronic; in the former, however, preceding their use by bloodletting. In chronic inflammatory disease we often employ what is termed a perpetual blister; that is, the cuticle is removed, and the blistered surface dressed with savine or cantharides ointment. This practice is advisable in chronic diseases of the chest, of the joints, of the eyes, &c. Blisters are sometimes used in erysipelas; thus to localize the disease when disposed to spread, and as a revulsive, applied to the feet, in erysipelas of the head. A blister to the perineum has been sometimes found beneficial in gleet.

It is hardly safe to apply blisters to children immediately after exanthematous diseases, sloughing being not an unfrequent result. If it be required to produce in them counter-irritation, the best plan is to dilute the common blistering plaster, by mixing with it three times its weight of soap cerate. I have seen this compound frequently employed, but never observed any unpleasant results from it. Another plan, sometimes adopted, is to apply a common blister, for an hour or two only, so that it shall merely produce rubefaction.

2. *Remote Uses*.—These will require examination under distinct heads, according to the particular object we have in view in employing cantharides.

a. *To act specifically on the Urinary Organs*.—In *dropsy*, they have been used to excite diuresis, though they frequently fail in producing this effect. In *diabetes*, cantharides have been employed, but without apparent benefit. In *paralysis of the bladder* they are frequently useful, when there are no marks of local irritation. Two opposite conditions may be the result of paralysis of this organ; namely, retention or incontinence of urine. The latter condition is not unfrequently met

¹ Dr. Paris, *Pharmacologia*.

with in children, and is very likely to be relieved by cantharides. It is usually stated they are particularly serviceable in that species of incontinence which occurs during sleep only; but I have seen them cure the disease during day, and fail in giving relief at night. The case alluded to was that of a boy, 14 years old, who had been subject to incontinence of urine since his infancy. He was a robust lad, and apparently in the most perfect health. I put him under the influence of gradually increased doses of cantharides, and within two months he was enabled to retain his urine by day, but it still passed involuntarily at night; and, though he continued the remedy for a considerable time, no further benefit was obtained. In incontinence of urine which occurs after lingering labours, from the long-continued pressure of the child's head, cantharides are sometimes serviceable. But their use must not be commenced until all the symptoms of local irritation have subsided.

β. *To act on the Organs of Generation*.—In consequence of the specific stimulus communicated by cantharides to the bladder, it has been supposed that the same influence might be extended to the uterus; and thus these insects have been employed as *stimulating emmenagogues*, in some cases with apparent benefit, but frequently without any obvious effect. Abortion has occasionally happened from their employment, as I have myself witnessed in one case.

Cantharides are also employed as an *aphrodisiac*, both in man and other animals (as horses, heifers, and asses). In man, if given in sufficient quantity to excite the sexual feelings, they endanger the patient's safety. Most of the cases in which we are requested to administer aphrodisiacs, will be found, on examination, to require moral rather than pharmacological treatment. In *discharges from the genital organs*, beneficial effects are frequently obtained by the internal use of cantharides. In gleet, they have been often found serviceable. Mr. Robertson¹ explains their efficacy by saying that they excite a mild inflammatory action on the urethra (shown by the discharge becoming thick, opaque, and puriform), which supersedes the previous morbid one. I have frequently found equal parts of tincture of chloride of iron and tincture of cantharides a successful combination in old-standing gonorrhœas. The dose is twenty drops at the commencement.

γ. *In Chronic Skin Diseases*.—Pliny states that cantharides (*Mylabris*) were employed in a disease which he terms lichen. At the present time, tincture of cantharides is not unfrequently employed in *lepra psoriasis*, and *eczema*. Having found other remedies very successful in lepra and psoriasis, I have rarely had occasion to try cantharides; but Rayer² says: "Of all the energetic and dangerous remedies that have been used in lepra, the tincture of cantharides is, perhaps, that which has the most remarkable influence over the disease. The great objection to its employment is its liability to excite inflammation in the digestive organs and urinary passages, especially among females, which necessitates the immediate suspension, and occasionally the entire abandonment, of the medicine." Bielt has found it successful in chronic eczema, as well as in the scaly diseases.

δ. *In diseases of the nervous system*, cantharides were at one time in great repute. The cases in which they were employed were hydrophobia, epilepsy, chorea, tetanus, and mania. Experience has shown that they deserve little attention in any of these complaints.

ε. *In obstinate sores*, Mr. Robertson recommends cantharides on the same principle that he uses them in gleet.

ADMINISTRATION.—*Powdered* cantharides are not unfrequently employed internally. The dose is one or two grains in the form of pill. The *tincture* is the safest preparation, and should, therefore, always be preferred.

ANTIDOTE.—In poisoning by cantharides, remove the poison as speedily as possible from the stomach. If sickness have not commenced, the removal may be effected by the stomach-pump, emetics, or tickling the throat (see treatment of

¹ *Practical Treatise on the Powers of Cantharides*, 1806.

² *Diseases of the Skin*, translated by Dr. R. Willis.

poisoning by OPIUM, *ante*). Assist the vomiting by mucilaginous and albuminous demulcent liquids—as linseed-tea, milk, white of egg, with water, &c. No chemical antidote is known. Oil was at one time thought to be an excellent remedy; but since the discovery of its being a solvent for the cantharidin, suspicion has been entertained that it is calculated to increase, rather than decrease, the patient's danger. This theoretical and plausible objection, first broached, I believe, by Pallas, seems supported by experience. Orfila found that cantharides macerated in cold oil, and afterwards given to dogs, killed them in a few minutes; and Dr. Christison says, "the case mentioned in the Genoa Memoirs was evidently exasperated by the use of oil." I confess, however, I think farther experience is required to determine the hurtful consequences of employing oil; for—as the editors of the *Dictionnaire de Matière Médicale* very properly observe—on the same principles that oil is prohibited, mucilaginous drinks ought also to be prescribed, since cantharidin, aided by the yellow matter, dissolves in water; and on the other hand, oil, in some cases, has appeared to be beneficial. To counteract the effects of cantharides, bloodletting, both general and local, opium, and the warm-bath, must be resorted to. Camphor was at one time highly esteemed for counteracting the effects of cantharides. Oleaginous and mucilaginous injections into the bladder are recommended to relieve the vesical symptoms.

1. ACETUM CANTHARIDIS (*Epispasticum*), L.; *Acetum Cantharidis*, E.; *Vinegar* (*epispatic*) of *Cantharides*; *Acetum Cantharidis*, D.—(Cantharides, rubbed to powder, ʒij; Acetic Acid Oj. Macerate the cantharides with the acid for eight days, occasionally shaking; lastly, express and strain, L.—"Cantharides, in powder, ʒij; Acetic Acid fʒv; Pyroligneous Acid fʒxv; Euphorbium, in coarse powder, ʒss. Mix the acids, add the powders, macerate for seven days, strain and express strongly, and filter the liquor," E.—Spanish Flies, in fine powder, ʒiv; Strong Acetic Acid fʒiv; Acetic Acid of commerce (sp. gr. 1044), fʒxvj. Mix the acids, and, having added the flies, macerate in a close vessel for fourteen days; then strain through flannel with expression, and filter, so as to obtain a clear liquid, D.)—Not fitted for internal employment. Applied to the skin as a convenient and prompt vesicant. In the formula of the London College, eight times as much cantharides are employed as in the tincture.

2. TINCTURA CANTHARIDIS, L. E. D. [U. S.]; *Tinctura Lyttæ*; *Tincture of Cantharides*.—(Cantharides, in powder, ʒiv; Proof Spirit Oij; [Spanish Flies, bruised, ʒj; Diluted Alcohol Oij, U. S.] Macerate for seven [fourteen, D., U. S.] days, [strain and express strongly the residuum, E.] express, and filter, D. "This tincture may be obtained much more conveniently and expeditiously by percolation, provided the cantharides be reduced to coarse powder, and left with a little of the spirit in a state of pulp for twelve hours before the process of percolation is commenced," E.)—The strength of this preparation is now uniform in the three British Pharmacopœias. Dose, ℥x, gradually increased to fʒj. Its effects on the bladder must be carefully watched. It should be given in some demulcent liquid, as barley water or linseed tea. It is sometimes employed externally as a rubefacient.

3. CERATUM CANTHARIDIS, L.; *Unguentum Cantharidis*, E.; *Cerate of Cantharides*.—(Cantharides, in very fine powder, ʒj; Spermaceti Cerate [Resinous Ointment, E.] ʒvj. [ʒvij, E.] Add the cantharides to the cerate, softened by heat, and mix.)—This preparation must not be confounded with the next one, than which it is more irritant. The uses of the two are the same. From the greater activity of the cerate, more danger of the absorption of the active principle of the cantharides is to be apprehended. When this occurs, the bladder becomes affected, and, in some cases, inflammation of the absorbents, and fever, are produced.

4. UNGUENTUM INFUSI CANTHARIDIS, E.; *Unguentum Cantharidis*, L. D. [U. S.]; *Ointment of Cantharides*.—(Cantharides, in very fine powder, ʒij [ʒij, U. S.]; Distilled Water fʒxij [Oss, U. S.]; Resinous Cerate ℥j [ʒvij, U. S.]. Boil the

water with the cantharides down to one-half, and strain. Mix the cerate with the strained liquor, then evaporate the mixture to a proper consistence, *L.*—"Cantharides, in moderately fine powder, Resin, and Beeswax, of each ℥j; Venice Turpentine and Axunge, of each ℥ij; Boiling Water ℥v. Infuse the cantharides in the water for one night, squeeze strongly, and filter the expressed liquid. Add the axunge, and boil till the water is dispersed. Then add the wax and resin; and, when these have become liquid, remove the vessel from the fire, add the turpentine, and mix the whole thoroughly," *E.*—Liniment of Spanish Flies f℥viiij; White Wax ℥ij; Spermaceti ℥j. Melt the wax and spermaceti in the oil with a gentle heat, and stir the mixture constantly until it concretes, *D.*)—A milder and less certain preparation than the preceding. Used to excite a purulent discharge from blistered surfaces, and to stimulate issues and indolent ulcers.

5. **EMPLASTRUM CANTHARIDIS**, *L. E. D.*; *Emplastrum Lyttæ*; *Plaster of Cantharides*; *Blistering Plaster*.—(Cantharides, in very fine powder, ℔bj; Wax, Lard, of each ℥viiss; Resin ℥ij; Lard ℥vj, *L.*—Cantharides, in very fine powder, Resin, Beeswax, and Suet, of each ℥ij, *E.*—Cantharides, in very fine powder, ℥vj; Yellow Wax, Resin, and Lard, of each ℥iv, *D.*—"Liquefy the fats, remove from the heat, sprinkle in the cantharides in very fine powder, and stir briskly, as the mixture concretes on cooling.")—[The *Ceratum Cantharidis*, *U. S.* Cerate of Spanish Flies, *Emplastrum Epispasticum*, is the same as this. It is made as follows: Take Spanish Flies, in very fine powder, ℔bj; Yellow Wax, Resin, Lard, each ℥viiij. Melt the wax, resin, and lard, and stir in the Flies until cool.] Dishonest druggists sometimes omit a portion of the cantharides here ordered, and substitute powdered euphorbium. In making blistering plasters, care must be taken not to add the cantharides while the melted lard is quite hot, as the heat greatly injures the vesicating power of the insect. For a similar reason the plaster should be spread by the thumb, a heated spatula being objectionable. To prevent the blister moving after its application to the skin, its margin should be covered with adhesive plaster. In order to guard against any affection of the urinary organs, place a piece of thin book-muslin or silver (tissue) paper between the plaster and the skin. The efficacy of the blister depends on the fatty matter dissolving the cantharidin, and transuding through the muslin or paper. Some recommend the paper to be soaked in oil, which is supposed to dissolve the cantharidin. Now oil, not being miscible with the blood, is not readily absorbed; and hence, it is supposed, arises its protective influence. The usual time requisite for a blistering plaster to remain in contact with the skin is twelve hours; the vesicle is then to be cut at its most depending part, and dressed with spermaceti ointment. When the irritation caused by these plasters is excessive, it is sometimes necessary to substitute a poultice for the ointment. When we wish to make a perpetual blister, the cerate of cantharides is employed as a dressing; or if we wish to excite less irritation, and prevent the possibility of the urinary organs being affected, the cerate of savine. The danger of applying blisters to children after exanthematous diseases, especially measles, has been already noticed (see p. 1125).

6. **EMPLASTRUM CANTHARIDIS COMPOSITUM**, *E.*; *Compound Plaster of Cantharides*.—(Venice Turpentine ℥ivss; Burgundy Pitch and Cantharides, of each ℥ij; Beeswax ℥j; Verdigris ℥ss; White Mustard Seed and Black Pepper, of each ℥ij. Liquefy the wax and Burgundy pitch, add the turpentine, and, while the mixture is hot, sprinkle into it the remaining articles previously in fine powder, and mix together. Stir the whole briskly, as it concretes in cooling, *E.*)—"This is supposed to be an infallible blistering plaster. It certainly contains a sufficient variety of stimulating ingredients."¹

7. **EMPLASTRUM CALEFACIENS**, *D.* [*Emplastrum Picis cum Cantharide*, *U. S.*]; *Warming Plaster*.—(Plaster of Cantharides ℔ss; Burgundy Pitch ℔vss. Melt

¹ Duncan, *Edinburgh Dispensatory*.

them with a steam or water-bath, and, withdrawing the heat, stir constantly until the mixture stiffens.) [The formula of the *U. S. P.* is as follows: Take of Burgundy Pitch lbijss; Cerate of Spanish Flies lbss. Melt them together by means of a water-bath, and stir them constantly till they thicken on cooling.] Stimulant, rubefacient, and, in some cases, vesicant. Used in catarrh, local pains, &c.

8. **PANNUS VESICATORIUS**; *Blistering Cloth*; *Taffetas Vesicant*.—(Digest powder of cantharides in sulphuric ether. Let the ethereal tincture be submitted to distillation, and the residue evaporated, by means of a salt-water bath, until ebullition ceases. The oily mass which remains is to be melted with twice its weight of wax, and spread on cloth prepared with waxed plaster,¹ *Henry and Guibourt*.²)—Employed as a substitute for the ordinary blistering plaster, than which it is a more convenient and elegant preparation.

The *Tela vesicatoria* or *Blistering Tissue*, and *Charta vesicatoria* or *Blistering Paper*, are analogous preparations.

The *Papier épispastique*, or *Epispatic Paper* of Henry and Guibourt, is prepared as follows: Take of white wax 8 parts, spermaceti 3 parts, olive oil 4 parts, turpentine 1 part, powder of cantharides 1 part, and water 10 parts. Boil slowly for two hours, constantly stirring it. Strain the fatty mixture through a woollen cloth, without expression, and spread on paper.

OTHER COLEOPTEROUS VESICANTS.

In Europe, the ordinary vesicating insect is the *Cantharis vesicatoria*; but in some other parts of the world other blistering insects are employed. Thus, *Cantharis vittata*, or the *Potato-fly*, *C. atrata*, *marginata*, and *cinerea*, are used in North America. In the Brazils, *C. atomaria* has been employed. *C. ruficeps*, a native of Sumatra and Java, is said to possess extraordinary blistering properties. *C. gigas* (*Lyttarærulea*, Pfaff) is a native of Guinea and the East Indies. *C. violacea* (*Lytta gigas mas*, Buchner) is a native of the East Indies. In Arabia, *C. syriaca* (*Lytta segetum*) is said by Förskal to be employed. *Mylabris Cichorii* is used in China and some parts of the East Indies. *Meloe proscarabæus* is an indigenous vesicating insect, which has in two instances caused death. *M. majalis*, or *true Mayworm*, possesses similar properties.

ORDER II. HEMIPTERA.—*Linneus*.

CHARACTERS.—2 wings covered by *elytra*. Mouth formed for suction; the *rostrum* composed of a tubular articulated sheath, including four scaly setæ, in place of mandibles and jaws. *Elytra*, in some, crustaceous, with the posterior extremity membranous; in others, almost similar to wings, but more extended, thicker, and coloured (Stark).³

355. COCCUS CACTI, *Linn. L. E. D.*—COCHINEAL INSECT.

(*Coccus*, *L.*—The entire insects, *E. D.*)

HISTORY.—The Spaniards, on their first arrival in Mexico, about the year 1518, saw the cochineal employed (as it appears to have been long before) by the native inhabitants of that country, in colouring some part of their habitations and ornaments.⁴

ZOOLOGY. **Gen. Char.**—*Tarsi* with 1 joint, and terminated by a single hook. *Male* destitute of a *rostrum*, with 2 wings covering the body horizontally; abdomen terminated by 2 setæ. *Female* apterous, furnished with a rostrum. *Antennæ* of 11 joints, filiform, and setaceous.

Sp. Char.—*Male* very small, with the *antennæ* shorter than the body; *body*

¹ The *Toile préparée à la cire*, used by the French pharmacologists, is prepared by spreading the following mixture on cloth: white wax 8 parts, olive oil 4 parts, and turpentine 1 part (Henry and Guibourt).

² *Pharmacopée Raisonnée*, 3me édit. p. 470, Paris, 1841.

³ *Elements of Natural History*, ii. 318.

⁴ Bancroft, *Experimental Researches*, i. 413; and Beckmann, *History of Inventions*, ii. 102.

elongated, of a deep red, terminated by 2 long diverging *setæ*; *wings* large, white, crossed above the abdomen. *Female* nearly twice as large as the male, bluish-red, covered with a white farina; *antennæ* short; *body* flattened below, convex; *feet* short.

Wings of the male beautifully snow white. The females fix themselves firmly on the plant, which serves them as a habitation, and never quit this spot; here they couple, and increase considerably in size. Each insect lays several thousand eggs, which proceed from the body through an aperture placed at the extremity of the abdomen, and pass under the belly to be there hatched. Death then ensues; the body of the mother dries up; its two membranes become flat, and form a sort of shell or cocoon, in which the eggs are inclosed, and from whence the little cochineals soon proceed. The female only is of commercial value.

Hab.—Mexico.

CULTIVATION.—The cochineal insects feed on the *Nopal* (*Opuntia cochinillifera*).¹ Mr. Ward^a says, the plantations are confined to the district of La Místeca, in the state of Oaxaca, in Mexico. The animals are domesticated and reared with the greatest care. Plantations of these are cultivated for the nourishment of the insects. Here the impregnated females are placed; this operation being denominated *sowing*. Young ones are soon de-

veloped; and some months afterwards, when the females have become fecundated and enlarged, the harvest commences. The insects are brushed off with a squirrel's tail, and killed by immersing them in hot water, and afterwards drying them in the sun, or by the heat of a stove. Three harvests are made annually; the first being the best, since the impregnated females alone are taken; in

Cochineal Insects (male and female).

- a. Male, with the wings expanded.
- b. Adult female (natural size).
- c. Adult female (magnified).
- d. Impregnated female (natural size).

Fig. 430.



Opuntia Cochinillifera.

the second the young females also are collected; and in the third both old and young ones, and skins, are collected indiscriminately. Before the rainy season commences, branches of the nopal plant, loaded with infant insects, are cut off and preserved in the houses of the Mexicans, to prevent the animals being destroyed by the weather.

COMMERCE.—In 1839, the quantity of cochineal on which duty (1s. per cwt.) was paid, was 489,998 lbs. In 1838 it was only 204,748 lbs. It is said that, on the average, one pound of cochineal contains 70,000 dried insects.

DESCRIPTION.—Cochineal (*coccus*; *coccinella*) consists of the dried female insects, which are about one or two lines long, wrinkled, of an irregular figure, convex on one side and flat or somewhat hollow on the other. They are inodorous, have a bitterish warm taste, tinge the saliva violet red, and yield a dark red powder. In

¹ *Cactus cochinillifer*, Linn., is without spines, and is called *Spineless Cochineal*; this does not produce the best Mexican Cochineal. De Candolle has given as *C. coch.* the *C. Tuna* of Linnæus—a plant totally distinct. *Cactus Tuna* yields the cochineal of Mexico. *C. cochinillifer* also yields *Opuntia maxima*.—Sloane, vol. ii. p. 152 t. 8, f. 1 and 2.

² Mexico in 1827, i. 84.

burning they evolve an animal odour, and leave a grayish-white ash. By infusion in water they swell up, show their ringed character, and even their feet, giving the liquid a red colour. Both the Honduras and Vera Cruz kinds are distinguished into the silver and black varieties. *Silver cochineal* (*cochinilla jaspeada* of the Spaniards) has a purplish-gray colour; but in all the furrows and depressions we observe a whitish powder, which, examined by the aid of a lens, appears like fine wool. *Black cochineal* (*cochinilla renigrada* or *grana nigra* of the Spaniards) is reddish or purplish-black, and devoid or nearly so of the silvery character. *Granilla* (*cochinilla sylvestre* or *grana sylvestria*) consists of very small cochineal insects, and smaller, wrinkled, globular, or ovate masses (cocoons and new-born insects?), somewhat like fragments of the cochineal insect.¹

An extensive system of adulterating cochineal, by a mercantile house in London, was discovered a few years ago. The genuine article was moistened with gum-water, and then agitated in a box or leather bag, first with powdered sulphate of baryta, then with bone or ivory-black, to give it the appearance of black cochineal. By this means the specific gravity of the cochineal was increased from 1.25 to 1.35, and 12 per cent. of worthless heavy spar sold at the price of cochineal.² Powdered talc and carbonate of lead have been used to give the silvery appearance. But a lens will readily distinguish these powders from the real wool, which gives the true silvery character.

COMPOSITION.—Two analyses of cochineal have been made; one by John,³ the other by Pelletier and Caventou.⁴ The latter chemists found the constituents to be *carmine*, *peculiar animal matter*, *fatty matter* (composed of *stearine*, *olein*, and an *odorous acid*), and *salts* (viz. phosphate and carbonate of lime, chloride of potassium, phosphate of potash, and a salt of potash, containing an organic acid).

COCHENILLIN (*Carmine*)—Obtained by digesting cochineal in ether, to extract the fatty matter, and then in alcohol, which dissolves the carmine. This colouring matter is a brilliant purplish-red substance, with a granular or crystalline appearance; unalterable in the air, easily soluble in water and alcohol, but insoluble in ether. It fuses at 112° F. Chlorine renders it yellow. Acids change its colour. The concentrated mineral acids decompose it. Alkalies render the watery solution of carmine violet. Lime-water forms a violet precipitate with it. The affinity of hydrate of alumina for it is most remarkable; the compound formed by their union is called a *lake*. [*Cochenillin* contains nitrogen, but its formula has not yet been determined. According to Preisser, the red colouring matter of the insect, which he calls *Carmine*, is derived by oxidation from the colourless crystalline compound called by him *carmine*—Ed.]

The pigment sold in the shops as *carmine*,⁵ and which is one of the most valuable colours employed by the painter in water colours, is a compound, of which cochenillin is one of the constituents. Pelletier and Caventou regard it as consisting of cochenillin, animal matter, and an acid.

PHYSIOLOGICAL EFFECTS AND USES.—Diuretic, diaphoretic, antispasmodic, and anodyne qualities have been assigned to cochineal, but without the least evidence of their existence. A mixture of carbonate of potash and cochineal is a popular remedy for hooping-cough. The only real value of cochineal is as a colouring matter, and as such it is used both in powder and solution. In the arts, it is extensively employed in dyeing scarlet and crimson, and in the manufacture of *carmine* and *lake*.

MANUFACTURE OF CARMINE.—[We subjoin the following note by the author on the manufacture of carmine, evidently the result of his own observation of the process pursued.—Ed.]

Carmine is prepared from *black cochineal*. A decoction of the insect in water is made. The residue is called *carmine grounds* (used by paper-stainers). To the decoction is added a precipitant—say bichloride of tin. Alum will not answer, as the colour is very different. The decoction to which the bichloride has been added is put into wash-hand basins, and allowed to stand. Slowly, a deposit takes place. It adheres to the sides of the vessel, and the liquid being poured off, it is dried. Artificial heat cannot be used, as it changes the colour of the

¹ See *Granillo*, in Bancroft's *Experimental Researches*, i. 435.

² *Ure*, *Dictionary of Arts and Manufactures*, pp. 305–6.

³ *Ann. de Chim. et de Phys.* viii. 250.

⁴ *Gmelin, Handb. der Chem.* ii. 1474.

⁵ *Carmine*, sold by the perfumers as *Rouge*, is very different from jeweller's *rouge* (oxide of iron). The carmine sold for theatrical performers must be largely diluted, as it has been sold at 10s. per ounce, when carmine, properly so called, was worth £3 or £4 per ounce.

deposit; neither can solar light be employed, for the same reason. This precipitate when dried is *carmine* [the liquor is called *liquid rouge*]. It can only be made in certain states of weather. If the weather be too hot, the liquids soon become sour, and the deposit is redissolved; yet fine weather is necessary, or the precipitate will not dry; flies also injure it. If carmine be not dry, it is apt to become mouldy.

The decoction from which the carmine has been precipitated yields a farther precipitate on the addition of more of the precipitant; but the product thus obtained is darker coloured, and is sold to the colour-makers as *lake*. It varies considerably in its tint.

Carmine is quite soluble in ammonia. Its colour should be remarkably bright. It should be also in the form of a light powder. These are the best tests of its goodness. *Carmine* is used for velvet painting, for pattern drawing for waistcoats, for water-colour painting, and as a face paint. Lady Dungannon's composition is composed of carmine, with a little water and ammonia. According to Bateinan, *rouge for the face* is made by mixing 1℔ss of levigated French chalk and 2 oz. of fresh carmine.

Six drachms of carmine may be obtained from 1 lb. of cochineal.

Cochineal is sometimes used for colouring pickled cabbage.

[Cochineal colouring for jellies, &c. is prepared by adding cream of tartar to a decoction of cochineal, and filtering. The pink saucers sold in colour shops are made up with a mixture of carmine, gum, and ammonia.—Ed.]

TINCTURA COCCI CACTI, D.—(Take of Cochineal, in fine powder, ʒij; Proof Spirit Oj. Macerate for fourteen days, strain, express, and filter.)

[The author has recommended the following preparation for the tincture of cochineal: Cochineal, in powder, one part; Rectified Spirit eight parts. Macerate for eight days, then filter.—Ed.]

ORDER III. HYMENOPTERA, *Linnaeus*.

CHARACTERS.—4 naked veined *wings* of unequal size. *Mouth* composed of jaws, mandibles, and 2 lips. *Lip* tubular at its base, terminated by a labium, either doubled or folded in, and forming a kind of sucker. *Females* with a compound ovipositor or sting at the anus (Stark).

356. APIS MELLIFICA, *Linn. L. E. D.*—THE HIVE BEE, OR HONEY BEE.

(1. Humor florum in favo repositus despumatus, *L.*; Saccharine secretion, *E. D.*—2. Cera, Favus preparatus; Cera alba, idem dealbatus, *L.*; Cera flava, Waxy secretion, Cera alba, Bleached beeswax, *E.*; Cera alba, Cera flava, *D.*)

HISTORY.—This animal was very anciently known, and is frequently referred to in the Old Testament. In all ages it has been an object of admiration and attention, on account of its industry, curious economy, and policy.

ZOOLOGY. Gen. Char.—*Labium* filiform, composing with the jaws a kind of *proboscis*, geniculate, and bent downwards. First joint of the posterior *tarsi* large, compressed. No spines at the extremity of the last two *legs*. Upper *wings* with one radial and three cubital cells (Stark).

Sp. Char.—Blackish. *Abdomen* of the same colour, with a transverse grayish band, formed by the down at the base of the third and following segment (Stark).

The honey bee lives in societies, called *swarms*, consisting of from fifteen to thirty thousand individuals. Each swarm is composed of three classes of individuals—viz. a female, males, and neuters. The female, called the *queen bee*, is narrower and longer than the others. The males, termed *drones*, are smaller than the females, and are devoid of stings. In each hive there are from 800 to 1000 drones. Towards autumn, when they can be of no farther use, they are destroyed by the neuters. The neuters are termed *working bees*, and are by far the most numerous, since in each hive there are from fifteen to thirty thousand. They are in reality females, whose ovaries are not developed, in consequence, as some have supposed, of the nature of the aliment with which they are supplied while in the larva state.

The **DIGESTIVE SYSTEM** of the animal consists of highly developed *salivary organs* communicating with the proboscis, of an *œsophagus* (which enlarges at one part, forming the *crop*, *sucking-stomach*, or *honey-bag*), a *proper stomach*, *small* and *large intestines*, and *biliary vessels*. The latter open into the alimentary canal immediately behind the stomach. The **SEXUAL SYSTEM**, in the *male*, consists of a *pair of testicles*, each having a *vas deferens*, which terminates in a *vesicula seminalis*. From the conjoined extremities of the *vesiculæ* proceed a *common duct* terminating in a *penis*. The *female genital organs* consist of *two ovaries* made up of tubes, each containing about twelve *ova*; the *two oviducts* from these ovaries terminate in a *vagina*, into which also opens a *duct* from a *roundish vesicle*. The **POISON APPARATUS** is found in the *females* and *neuters* only. It consists of *two thin convoluted secreting organs*, opening into a *pyriform receptacle*, from which a *small duct* passes to the *sting*, which consists of two portions placed side by side, barbed at the extremity and contained in a sheath. The *poison* is said to be hot and acrid to the taste. The consequences produced by the sting of a bee are pain, redness, swelling, and hardness of the part; and might prove fatal if a swarm were to attack an individual. The removal of the sting (if left within the wound), and friction with saliva, or with oil and harts-horn, is all the treatment usually required.

Hab.—Old continent (Latreille). In a state of nature they reside in hollow trees; but they are almost universally domesticated, and are preserved in *hives*. Curtis¹ has described and depicted a remarkable instance of the nest of some hive bees attached to the arm of a tree. It was discovered in 1838, by Lord Malmesbury, in his plantation near the River Avon.

Bees furnish two products useful in medicine—viz. *honey* and *wax*.

a. HONEY. PRODUCTION.—Honey (*mel*) is secreted by the nectariferous glands of flowers, and is collected by the working or neuter bees, who take it by suction or lapping, and pass it into the dilatation of the *œsophagus*, denominated *crop*, *sucking-stomach*, or *honey-bag*; beyond which, we presume, the honey does not pass, as it has never been found in the true stomach. When the animal arrives at the hive, the honey is disgorged by a kind of inverted peristaltic motion, and is probably somewhat altered in its properties by the secretions of the crop. It is used by the animal as food.

PHYSICAL PROPERTIES.—Honey varies in its taste and odour according to the age of the bees and flowers on which they have fed. A hive which has never swarmed is considered to yield the best, which is therefore called *virgin honey*. The flavour of Narbonne honey, which is so much admired, is said to arise from the labiate flowers on which the animals feed; to imitate this, a sprig of rosemary is sometimes added to the honey obtained from other places.

PURITY.—Flour, it is said, is now and then mixed with honey. This adulteration may be readily distinguished by its insolubility in cold water, and by the blue colour produced by the addition of iodine.

The London College directs that honey—

Is not to be employed without being despumated. Dissolved in water, iodide of potassium and acid being added, it does not become of a blue colour.

CHEMICAL PROPERTIES.—The constituents of honey vary somewhat according to the food of the bees, the season, the age of the animals, the mode of extracting it from the combs, &c. It must, however, be regarded at all times as a concentrated solution of *sugar* mixed with *odorous*, *colouring*, *gummy*, and *waxy* matters. The saccharine matter is of two kinds: one crystallizable, and analogous to the sugar of grapes; the other uncrystallizable, and similar to the uncrystallizable brown syrup of the sugar-cane. Guibourt has found also mannite, which differs from sugar in not fermenting when mixed with water and yeast.

PHYSIOLOGICAL EFFECTS.—Honey is emollient, demulcent, nutritive, and laxative. When fresh it is apt to occasion indigestion and colic. Collected from poisonous plants it has been found to possess deleterious qualities. The honey of Trebizond has long been notorious for its deleterious qualities. Mr. Abbott² says it causes violent headache, vomiting, and a condition like that of a tipsy man. A larger dose produces deprivation of all sense and power for some hours afterwards. These

¹ *British Entomologist*, xvi. pl. 769.

² *London and Edinburgh Philosophical Magazine* for October, 1834, vol. v. p. 313.

effects agree with those assigned to this honey by Xenophon,¹ in his account of the "Retreat of the Ten Thousand." Pliny² also speaks of this poisonous honey. Tournefort³ ascribes its venomous properties to the bees feeding on the *Azalea pontica*. Many other instances of poisonous honey are on record.⁴

USES.—Mixed with flour, and spread on linen or leather, it is a popular application to promote the maturation of small abscesses and furunculi. It sometimes forms a constituent of gargles, partly on account of its taste, partly for its emollient operation. It is also used as a vehicle for the application of other more powerful agents to the mouth and throat, especially in children. It is occasionally employed as an emollient and demulcent in inflammatory affections. In troublesome coughs, barley-water, mixed with honey, and sharpened with slices of lemon, and taken warm, forms a very agreeable and useful demulcent to allay troublesome coughs.

1. MEL DEPURATUM, D.; *Clarified Honey*.—(Melt the honey in a water-bath, and strain it while hot through flannel.)—The object of this process is to deprive honey of certain impurities which render it apt to ferment; but the flavour and odour of the honey is somewhat injured by the operation.

2. OXYMEL.—See p. 947.

β. WAX. SECRETION OF BEESWAX.—Beeswax (*cera*) was at one time supposed to be merely the pollen of plants elaborated by bees. Bonnet, however, so early as 1768, asserted it to be a secretion from the ventral scales. Hunter⁵ and Huber have subsequently proved the correctness of this assertion. The latter writer, indeed, proved that the pollen is not at all essential to the production of wax, for bees fed on honey and water equally secreted it, and formed the usual waxy cells. With this wax they construct the *comb* (*favus*), the cells (*alveoli*) of which are hexagonal with angular bottoms.⁶ The substance called *Propolis* is collected by the bees from the buds of trees. It is of a resinous nature, and is used for lining the cells of a new comb, stopping crevices, &c.

Fig. 431.



Cicada limbata.

Other animals secrete wax. Thus the larva of the *Cicada limbata* or *white wax insect* of China is covered with a waxy powder, which is communicated to the trees upon which these insects are found, and is collected by the natives, who esteem it highly as a medicinal substance.⁷

Wax is also a product of vegetables; but *vegetable wax* is not employed in this country. *Myrtle wax* is obtained from the berries of the *Myrica cerifera*, a native of the United States of America. These are boiled in water and pressed. The wax exudes, floats on the water, is skimmed off, and is remelted. This kind of wax has a greenish-yellow colour. By saponification it yields stearic, margaric, and oleic acids, along with glycerine, so that it is rather fat than wax.

PREPARATION.—Wax is extracted from the comb, partly by allowing the latter to drip, partly by subjecting it to pressure. The comb is then melted in water, by which the impurities subside, and the wax is allowed to cool in moulds.

PROPERTIES OF YELLOW BEESWAX.—Yellow wax (*cera flava*) has a remarkable and peculiar odour; its colour is more or less yellow, but varying in degree; its specific gravity varies from 0.960 to 0.965. [It melts at 145°—Fb.] It is said to be sometimes adulterated with suet, which gives it a fatty and disagreeable taste. Resin may be recognized by its solubility in cold alcohol; bean or pea meal, by its insolubility in oil of turpentine.

WAX BLEACHING.—This is effected by melting yellow wax (either in a copper vessel, or in a large vat or tub, by means of steam), running it off, while in a melted

¹ *Anabasis*, lib. iv.

² *Hist. de l'Acad. Roy. des Sciences*, p. 351, 1704.

³ See Barton, *Philosophical Magazine*, xii. 121; and in Beck's *Medical Jurisprudence*; also, Hamilton's *Travels in Asia Minor*, 1842.

⁴ *Philosophical Transactions* for 1792, p. 143.

⁵ On their mathematical form, consult Waterhouse, in the *Penny Cyclopædia*, art. *Bee*; and Lord Brougham's *Dissertations on Subjects connected with Natural Theology*, i. 218. 1839.

⁷ See Donovan's *Insects of China*.

² *Hist. Nat.* xxi. 44, ed. Valp.

state, into a trough, called a *cradle*, perforated at the bottom with holes, and placed over a large water-tank, at one end of which is a revolving cylinder, almost wholly immersed in water. By this means the wax is solidified, converted into a kind of ribbon, and conveyed on the surface of the water to the other end of the tank. These ribbons of wax are here lifted out, and conveyed in baskets to the bleaching-grounds, where they are exposed to the air one or two weeks (according to the state of the weather), being turned every day, and watered from time to time. The wax is then remelted, reribboned, and rebleached; it is subsequently refined by melting in water acidulated with sulphuric acid.

PROPERTIES OF WHITE WAX.—White wax (*cera alba*; *cera dealbata*) is yellowish-white; I have never met with pure wax perfectly white. The circular cakes of commerce, as well as wax candles, always contain spermaceti, which the dealers add to improve the colour. Pure wax is solid, brittle, inodorous, or nearly so, insipid, fusible, and at a much higher temperature decomposable. Its specific gravity varies from 0.8203 to 0.965. [It melts at 158°, and congeals at 149°.—Ed.]

COMPOSITION.—According to John, wax is a compound of two other substances;—the one called *cerine*, the other *myricine*. [The former is soluble in alcohol, the latter is comparatively insoluble.—Ed.] These have been examined by Boudet and Boissenot.¹

1. **CERINE.**—This constitutes at least 70 per cent. of wax. It fuses at 143½ F. It dissolves in 16 parts of boiling alcohol. By saponification with potash it yields margaric acid, a minute portion of oleic acid, and a considerable quantity of a non saponifiable fat called *cerüne*.

2. **MYRICINE.**—It fuses at 149° F. It dissolves in 200 parts of boiling alcohol of sp. gr. 0.833. It is not saponifiable by potash. Etling² says that cerine, ceraine, and myricine are isomeric, and composed of C¹⁹H¹⁹O. More recently, Hess³ asserts that pure wax is homogeneous, and possesses the properties of myricine; its composition being C²⁰H²⁰O. The difference between cerine and myricine he ascribes to the presence of *ceric acid* formed by the oxidation of myricine.

[Mr. B. C. Brodie has made an extensive series of researches into the constitution of wax, and has assigned formulæ to sixteen different constituents or products of the decomposition of wax. He applies the name *cerotic acid* to cerine, and represents its formula as C⁵⁴H⁵⁴O⁴. Pure myricine he considers to be represented by C⁹²H⁹²O⁴.⁴ It is remarkable that in nearly all the varieties of wax, as well as in the products obtained from this body, the carbon and the hydrogen are in equal equivalents.

Beeswax varies much in the proportions of cerine and myricine which it contains. Wax is obtained from the vegetable kingdom. *Myrtle wax* is derived from the *Myrica cerifera*. From the action of potash it appears to be more analogous to the fatty bodies than to wax. Its formula is C³⁶H³⁶O⁵. The *Chinese* and *Japan wax* is the produce of *Rhus Succedaneum*. It is white and crystalline, resembling spermaceti. Formula=C³⁶H³⁶O². The *sugar-cane wax* has been called *Cerosine* by Dumas. It is a wax-like substance, deposited in fine light pearly scales on the surface of some species of sugar-cane. It melts at 180°, and is not saponified by potash. Its formula, according to Dumas, is C⁴⁸H⁵⁰O².—Ed.]

PHYSIOLOGICAL EFFECTS AND USES.—Wax is an emollient and demulcent. It has been administered internally, in the form of emulsion (prepared with melted wax and soap, yolk of eggs, or mucilage), in *diarrhœa* and *dysentery*, especially when ulceration of the alimentary canal is suspected. In these cases it has been used by Hufeland and Wedekind. It has sometimes been employed as a *masticatory*; but its action is mechanical only. Its principal use, however, is *externally*, sometimes as a mild sheathing or protecting application, sometimes as a basis for the application of other agents. It is a constituent of all *cerates*, which take their name from it. The vapour evolved from wax placed on redhot iron has been inhaled in phthisis.

¹ Journ. de Pharm. xiii. 38.

² Pharm. Central-Blatt für 1838, p. 332.

³ Thomson, *Organic Chemistry*.

⁴ *Philosophical Transactions* for 1849, p. 106.

1. **EMPLASTRUM SIMPLEX**, E.; *Emplastrum attrahens*; *Wax Plaster*.—Beeswax ʒij; Suet and Resin, of each ʒij. "Melt them together with a moderate heat, and stir the mixture briskly till it concretes on cooling," E.—Used to promote discharge from a blistered surface.

2. **CERATUM**, L.; *Unguentum simplex*, E.; *Unguentum Cereæ albæ*, D. [*Ceratum simplex*, U. S.]; *Simple Cerate*; *Simple Dressing*.—(Olive Oil Oj [ʒvss, E.]; Wax ʒxx [White Wax ʒij, E.]; White Wax ʒbj; Prepared Hogslard, ʒiv, D. Add the oil to the melted wax, and mix (and stir the mixture briskly while it concretes on cooling, E.)—[The U. S. Pharm. directs Lard ʒviiij; White Wax ʒiv.] A mild and cooling dressing. Sometimes used as a basis for more active preparations.

3. **LINIMENTUM SIMPLEX**, E.; *Simple Liniment*.—(Olive Oil four parts; White Wax one part. Dissolve the wax in the oil with a gentle heat, and agitate well as the fused mass cools and concretes.)—Differs from the *Unguentum simplex* in its greater liquidity. Used to soften the skin, and to promote the healing of chaps.

OTHER HYMENOPTEROUS INSECTS.

The tribe of hymenopterous insects, called *Gallicolæ* or *Diplolepariæ*, contains the insects which produce those excrescences on plants commonly denominated *galls* (see *Nutgall*, and *Bedeguar*). Latreille¹ comprehends all the insects of this tribe in one genus—viz. *Cynips*.

Class VII. Crustacea, Cuvier.—Crustaceans.

The dietetical properties of the Crustaceans (Lobsters, Crabs, Cray-fish, Prawns, and Shrimps) have been noticed in a former part of the work.

Fig 432.



Astacus fluviatilis.

1. **ASTACUS FLUVIATILIS**.—In the stomach of the *Cray-fish* are found, at the time the animal is about to change its shell, two calcareous concretions, commonly called *Crabs' Eyes* or *Crabs' Stones* (*Lapilli Cancrorum*), which were formerly ground and employed in medicine, as absorbents and antacids under the name of *Prepared Crabs' Stones* (*Lapilli Cancrorum preparati*; *Lapides Cancrorum preparati*; *Oculi Cancrorum preparati*).² They consist of carbonate of lime and animal matter principally, with a little phosphate of lime. Their use is now obsolete. In the shops, imitations of them (prepared with chalk and mucilage, or size) are still met with.

2. **CANCER PAGURUS**.—The *Black-clawed* or *Large Edible Crab* was at one time an officinal animal. Its *Claws* (*Chela Cancrorum*), when prepared by grinding, constitute the *Prepared Crabs' Claws* (*Chela Cancrorum preparata*) of the shops. Their composition and uses are similar to those of prepared Crab's stones. I have already given an account of the effects and uses of carbonate of lime.

¹ In Cuvier's *Règne Animal*, v. 291, 1829.

² "Those animals which are ready to moult, have always two stony substances, called *crabs' eyes*, placed in the stomach, which, from the experiments of Reaumur and others, appear destined to furnish the matter, or a portion of it, of which the shell is formed; for if the animal is opened a day after its moult, when the shell is only half hardened, these substances are found only half diminished; and if opened later, they are proportionably smaller." (Küby, *Bridgewater Treatise*, vol. ii. p. 55; quoted by Bence Jones, p. 79.)

Division II. Vertebrata.—Vertebral Animals.

CHARACTERS.—Animals furnished with a *skull* and *vertebral column* for the protection of the brain and spinal marrow.

Class VIII. Pisces.—Fishes.

CHARACTERS.—Vertebrate animals with cold red *blood*, respiring by *gills* or *branchiæ*, and moving in the water by the aid of *fins*.

No article of the *Materia Medica*, contained in the British pharmacopœias, is derived from this class of animals; but the important uses of *isinglass*, and the extraordinary efficacy, in various diseases, ascribed by some writers to *cod-liver oil*, render it necessary to notice both of these productions.

357. ICHTHYOCOLLA.—ISINGLASS.

HISTORY.—Ichthyocolla (ἰχθυόcolla, from ἰχθὺς, *a fish*; and κόλλα, *glue*) is mentioned by both Dioscorides¹ and Pliny.² The latter of these writers ascribes its invention to Dædalus.

ZOOLOGY.—Isinglass is obtained from various fishes, some only of which have hitherto been ascertained. The finest kinds are procured from different species of *Acipenser*. Several other genera—as *Silurus*, *Morrhua*, *Gadus*, *Otolithus*, *Lota*, and *Polynemus*, also yield it.

The organ from which isinglass is usually procured is the *air-bag*, or *swimming bladder*, sometimes termed the *sound*. It is a membranous sac filled with air (containing from 69 to 87 per cent. of oxygen), and placed under the spine, in the middle of the back, and above the centre of gravity. In most fish it communicates with the œsophagus, or stomach, by the *ductus pneumaticus*. In others, it is an imperforate sac. Occasionally there are two sacs, which communicate with each other. In the *Acipenser stellatus*, according to Brandt,³ the bag is composed of three membranes: an external, silvery one, derived from the peritoneum; a middle, membranous (*hautigen*) one; and the most internal, very vascular, and, as it were, pulpy membrane. The latter, he states, yields the fish gelatine. But unless the sound of this fish differs considerably from that of other fishes, there must be an error in this statement. I have examined all the purse and pipe isinglass of commerce, and find the internal to be an insoluble membrane. In the cod, the innermost membrane is very thin, and is perhaps analogous to the epithelium. Externally to this is a highly vascular thin coat, and still more externally is the gelatinous coat, which appears devoid, or nearly so, of vessels.

PREPARATION.—The mode of preparing the swimming-bladder for sale as isinglass, varies in different countries. Sometimes the bag is dried unopened, as in the case of the *purse*, *pipe*, and *lump* isinglass of the shops. At other times it is laid open, and submitted to some preparation; being either dried unfolded, as in the *leaf* and *honeycomb* isinglass; or folded, as in the *staple* and *book* isinglass; or rolled out, as in the *ribbon* isinglass. When it arrives in this country it is *picked* or *cut*. Formerly, it was picked into shreds by women and children, but it is now usually cut by machines worked by steam.

DESCRIPTION.—Many varieties of isinglass are imported; the Russian kinds are the most esteemed; but the Brazilian, on account of its cheapness, is very extensively used.

¹ Lib. iii. cap. 102.

² Hist. Nat. lib. vii. cap. 57; and lib. xxxii. cap. 24, ed. Valp.

³ Brandt and Ratzeburg's *Medicinische Zoologie*, p. 27, Berlin, 1833.

1. Russian and Siberian Isinglass.—The isinglass produced in the Russian empire is principally obtained from the sturgeons. These cartilaginous fishes constitute the genus *Acipenser*.

The following are the generic characters of *Acipenser*: Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows; snout pointed, conical; mouth placed on the under surface of the head, tubular, and without teeth (Yarrell¹). The species are badly determined. Brandt² has described and figured eight. *Acipenser Sturio*, or the *Common Sturgeon*, is occasionally caught in the River Thames. The species from which ISINGGLASS is procured are the following:—

1. *A. Huso*, Linn. The *Beluga* or *Bielaga*.—Inhabits the Caspian Sea and its tributary streams. Its roe (ovary) is esteemed as *caviare*. Its swimming-bladder, when properly prepared, yields *leaf isinglass* of three qualities, *fine firsts*, *firsts*, and *seconds*.

2. *A. GULDENSTADTII*, Brandt and Ratzeburg. The *Ossetr* or *Osseter*.—Inhabits the Caspian and Black Seas and their tributary rivers. *Caviare* is prepared from its roe (ovary). From its swimming-bladder are obtained both *staple* and *leaf isinglass*. The varieties of the *staple* are the *Patriarch Astrakhan*, and *Astrakhan firsts*, *seconds*, and *thirds*. The *leaf* varieties are *firsts*, *seconds*, and *thirds*.³

3. *A. RUTHENUS*, Linn. The *Sterlet*.—Inhabits the Black and Caspian Seas and their tributary rivers; and the Arctic Ocean. Its roe yields *caviare*. *Leaf* and *book* (*first* and *second*) *isinglass* are obtained from the swimming-bladder.

4. *A. STELLATUS*, Pallas. The *Seuruga*.—Inhabits the Caspian and Black Seas and their tributary rivers. Yields *caviare* and *leaf isinglass*.

[WE subjoin some remarks by the author on the swimming-bladders of several species of *Acipenser* from the Volga. These were published in the *Pharmaceutical Journal*.⁴—ED.]

Professor Ludewig kindly sent me the dried air or swimming-bladders of three species of *Acipenser*, namely, the *A. Huso*, *A. Guldensadtii*, and *A. stellatus*. I had been for some time anxious to possess specimens of these swimming-bladders, in order that I might farther satisfy myself of the real nature and position of the isinglass membrane.

In the second edition of my *Elements of Materia Medica*, pp. 1859 and 1861, I have stated that the innermost layer of the swimming-bladder is insoluble in boiling water, and is not the gelatinous or isinglass membrane. I came to this conclusion from a careful examination of the sound of the codfish, and of the unopened pipe and purse isinglass of commerce, all of which I found to be lined with an insoluble epithelium. In the leaf isinglass, imported from Russia, this membrane has been removed, probably by rubbing with a cloth; and as in some species of *Acipenser* this layer is exceedingly fine, its presence is apt to be overlooked. But in the swimming-bladders of some other fishes it is much thicker, and its non-removal in them considerably deteriorates the commercial value of the isinglass which they yield. The insolubility of the inner lining of the Hudson Bay purse isinglass is well known to the dealers.

Dr. Edward Martiny, the learned author of the *Naturgeschichte der für die Heilkunde wichtigen Thiere*, published at Darmstadt last year, has, however, denied the accuracy of my account of the gelatinous or isinglass membrane. He describes these bladders as consisting of two membranes (*Hauten*), an *outer*, strong, shining, and fibrous membrane, and an *inner* soft mucous coat. The outer membrane is covered by a peritoneal coat. "The inner membrane, namely, the mucous membrane, is the so-called isinglass." To this sentence he has appended a foot-note, of which the following is a translation:—

"Pereira (*Elements of Materia Medica*, vol. ii. 2d ed. p. 1861) erroneously regards the middle coat as yielding gelatine."

This statement, emanating from so high an authority as Dr. Martiny, induced me to re-examine the subject, and the result is the confirmation of the accuracy of my former statement. I have now examined the swimming-bladders of four species of sturgeon, and in all find their inner coat, or lining, to consist of an epithelium insoluble in water. In some, however, it is so exceedingly delicate as to require very careful microscopic examination to detect it. In the spring of the present year, I obtained the swimming-bladder of the common sturgeon (*Acipenser Sturio*) caught in the Thames, and found its lining membrane to be a very delicate, but insoluble epithelium. I gave a portion of it to my friend Mr. John Quekett, of the Royal College of Surgeons, and requested him to examine it, and the following is the reply which he sent me:—

"I have carefully examined the sections of air-bladder, and I find that, commencing with the inner coat, you have—

"1st. An epithelial layer; then,

"2dly. The membrane to which the epithelium is attached (basement-membrane); then,

¹ *History of British Fishes*, ii. 360.

² T. W. C. Martius, *Lehrb. d. pharm. Zool.* S. 76, 1838.

³ *Med. Zool.* ii. 1 and 349.

⁴ Vol. vii. No. 10, April, 1848.

"3dly. Some flaky spindle-shaped bodies, which give the silvery appearance: then,

"4thly. Some fibrous tissue, arranged principally in two directions, probably the muscular or elastic coat; then,

"5thly. Some areolar tissue; and,

"6thly. Lastly of all the serous coat.

"I have not tried the solubility of these layers in boiling water, but should think it must be the middle or thick substance which is the gelatinous coat."

On the receipt of the air-bladders of the three species of *Acipenser*, sent me by Professor Ludewig, I resolved to submit them to a careful microscopic examination, in order to ascertain in them the existence or absence of an inner epithelial or insoluble layer. I have detected it in all of them.

a. *Acipenser Huso*.—This fish, called by the Russians the *Bieluga*, yields the isinglass known by the name of the *Bieluga* (or *Beluga*) leaf. The dried air-bladder is a pyriform bag about the size of a small pig's bladder. Its length is about eleven inches, its greatest diameter about five inches. The opening of the ductus pneumaticus is near the larger extremity.

b. *Acipenser Guldenstadti*.—From this fish is obtained both *staple* and *leaf* isinglass. The dried pyriform swimming-bladder, now laid before the Society, is of the kind called in commerce the pipe. Its length is about ten inches, and its greatest diameter about three inches. The opening of the ductus pneumaticus is at the larger extremity.

c. *Acipenser Stellatus*.—This yields *leaf* isinglass. The pyriform swimming-bladder of this fish, which I have received from Professor Ludewig, is also of the pipe kind. Its length is eight inches, and its greatest diameter two and a half inches.

But in Russia the acipenser is not the only genus from which isinglass is obtained, for it is also procured from *Silurus Glanis*,¹ which Dr. Royle² suggests may be the source of the *Samovey*³ isinglass of commerce.

Brandt⁴ thus describes the preparation of Russian isinglass. The swimming-bladder is cut open, washed, and then exposed to the air with the inner silvery membrane turned upwards. The latter is then stript off and placed in damp cloths or left in the outer covering, and prepared or kneaded. It is then taken out of the cloths, and either merely dried (*leaf isinglass*) and twisted or folded in a serpentine manner, between three pegs, into the shape of a horseshoe, heart, or lyre (*long* and *short staple*), or folded in the manner bookbinders fold printed sheets of paper (*book isinglass*). Jackson⁵ has given figures to illustrate the manner in which the staple and book isinglass are made to retain their shapes by skewers. Several kinds of *leaf isinglass* are imported from Russia. The finest kind is that from Astrakhan, of which one kind is said to be obtained from the *Beluga* (*Acipenser Huso*). These are imported from St. Petersburg. The *Samovey leaf* is an inferior kind brought from Taganrod. *Sisane leaf* is the produce of a small fish; each leaf measuring only about 2½ inches each way, and weighing about a drachm; it looks like pieces of dried bladder, marked by two fibrous or muscular bands. *Kroski isinglass* I have not seen; but I am told it is in small, circular, membranous disks. *Long staple isinglass* is of fine quality. It is the produce of the Oural. [It is usually imported loose—at times strung on ropes. The latter kind is preferred.] Of *short staple* three kinds are known; the finest is from the Oural, and is distinguished by the name of Patriarch, but it is very scarce. The *Astra-*

¹ Pallas, *Reise durch verschiedene Provinzen des russischen Reichs*, Th. i. S. 139, Petersb. 1771.

² On the Production of Isinglass along the Coasts of India, with a Notice of its Fisheries, p. 29. Lond. 1842.

³ This word is sometimes written *Samovey* or *Simovy*. I have been unable to trace its derivation. Dr. Royle's suggestion appears to me probable, since the Russian name for the *Silurus Glanis* is *Som*, while Albertus Magnus calls it *Sumus*. The Poles term it *Szum*.—(Brandt and Ratzeburg, *op. supra cit.* ii. 31.) Moreover, Martius says that staple, leaf, and book isinglass are produced from this fish. Now these are the three forms of the *Samovy* isinglass. [A note addressed to the author confirms this view. The isinglass in question comes from the Russian fish *Som*. The Russians having no article, make an adjective of *Som* by adding "ovy." They pronounce it *Samovy*, although they spell it *Simovy*. There is another kind called *Leshovy*, from the fish *Lesh* or *Leshthik* (Bream). It is more soluble than the *Samovy* kind, but scarcely of equal strength.—Ed.]

⁴ Though the account above given by Brandt agrees with the statements of Pallas, Gmelin, Georgi, and Tooke, there must be some inaccuracy in it. I have before stated that the innermost membrane of the swimming-bladder is insoluble—but according to Brandt's statement, the innermost is the gelatinous membrane. The account which T. W. C. Martius (*Lehrbuch d. pharmaceut. Zoologie*, p. 71, Stuttg. 1838) gives of the preparation of isinglass in Russia confirms my views. The swimming-bladders, he observes, are first placed in hot water, carefully deprived of adhering blood, cut open longitudinally, and exposed to the air, with the inner delicate silvery membrane upwards. When dried, *this fine membrane is removed* by beating and rubbing, and the swimming-bladder is then made into different forms.

⁵ Royle, *op. supra cit.* p. 21.

khan short staple is one of the best kinds. The *Samovey short staple* is of inferior quality. Two kinds of *book isinglass* are met with. That from the Oural is of excellent quality. *Samovey book* is an inferior kind. *Siberian purse isinglass* is of moderately good quality, and is in general demand. [A small kind on strings, in a necklace form, is sometimes imported.]

2. Brazilian Isinglass.—This is imported from Para and Maranham; but it has not hitherto been ascertained from what fishes it is procured; though it is obvious, from a superficial examination of the commercial specimens, that they must have been obtained from at least several species or genera. Mr. Yarrell² suggests the genera *Pimelodus* and *Silurus* as the source of it. It comes over in the form of *pipe, lump, and honeycomb*. *Pipe Brazilian isinglass* must have been procured from a large fish. It is prepared by drying the swimming-bladder unopened. In some cases this bladder is imported distended with air. The dried bladders, or *pipes*, as they are called, are from ten to twelve inches in length, and two or two and a half inches broad. Their weight is about five ounces. Their shape is somewhat conical, tapering at one extremity and broader at the other, where, on either side, is a conical cæcal prolongation. It is devoid of smell. *Lump Brazilian isinglass* consists of two swimming-bladders placed side by side, considerably separated at one end, and communicating at the other extremity with each other. When perfect, each lump somewhat resembles in shape a torpedo. Its size varies. A perfect, though not very large specimen, measured eight inches in length, and, at the broadest part, five inches in breadth. Its weight is six ounces and a half. It consists of three portions, separated by constrictions. The largest portion is five inches broad, and three inches and a half long; flattish in front, rounded posteriorly. It consists of two sacs, placed one on either side. The middle portion is oblong, three inches long, and two inches broad; it consists of two sacs, which communicate with those of the preceding portion. The third portion is oblong, one inch and a half long, and three-quarters of an inch wide. It consists of one sac only, into which both the sacs of the middle portion open. *Honeycomb Brazilian isinglass* appears to be the largest portion of the lump kind split open. The lump variety is sometimes softened, and rolled out into thin ribbons, in this country. On account of its deeper colour and inferior solubility, Brazilian isinglass is not in demand for domestic use; though, as it is sold in the cut state, it is probably largely intermixed by shopkeepers with the finer kinds of Russian isinglass, and sold as such. As it is moderately cheap and soluble, it is in extensive use for fining by brewers, who are the principal consumers of this kind of isinglass. [When digested with boiling water, it leaves a very large proportion of undissolved white residue of a starchy consistence.]

3. New York Isinglass.—Occasionally, *ribbon isinglass* is imported from New York. It is in thin ribbons of several feet long, and from an inch and a half to two inches in width. It is but little used in this country. It is less soluble than the Russian, and affords a dark-coloured solution.³ Dr. J. V. C. Smith,⁴ author of a work on the fishes of Massachusetts, states that it is obtained from the air-bladder of the common Hake (*Gadus merluccius*), which is thrown into water to macerate for a little while, and is then taken out and pressed between two iron rollers, "by which it is elongated to the extent of half a yard and more. It is then carefully dried, packed, and sent to market. The common cod (*Morrhua vulgaris*) yields a poorer kind of isinglass; but the hake only is known to the extensive manufacturers as fit for their purposes."

4. Hudson's Bay Isinglass.—I have been unable to ascertain from what fish this isinglass is procured.⁵ It comes over in the *purse* form. A specimen in my

¹ Sometimes called *Cayenne Isinglass* (Guibourt).

² *Philosophical Transactions*, vol. lxiii. 1783.

³ *United States Dispensatory*; also *Journal of the Philadelphia College of Pharmacy*, vol. iii. pp. 17 and 92.

⁴ In a letter to Dr. S. W. Williams, of Deerfield, Massachusetts, from whom I received the above information.

⁵ Richardson, in his *Fauna Boreali-Americana*, part iii. says, that the sturgeons of North America are equally numerous with those of Asia, but that their sounds and roes are utterly wasted.

possession measured twelve inches in length, and three inches and a half in diameter; its weight is one ounce and a half. It is of a light yellow colour, translucent, and free from taste and smell. The inner lining of the sac, which may be readily stripped off, is insoluble in water; the remaining membrane dissolves in boiling water.

5. East India Isinglass.—It appears that, for a long period, this has been exported from Calcutta to China, but it has only recently occupied the attention of Europeans. It is probably the produce of a species of *Polynemus*.¹ But the fishes called by Dr. Buchanan, *Bola*, and several species of *Silurus*, especially *Silurus raita*, also yield isinglass (Royle). Most of the specimens of Indian isinglass which I have examined have an unpleasant fishy odour, which renders them totally unfit for domestic use, and greatly deteriorates their commercial value. A specimen of *East India purse isinglass* which I examined consisted of an unopened swimming-bladder, flattened and dried. Its shape is oval-oblong; its length nine inches; its breadth three inches and a half; its weight seven ounces and a half. It has a strong fishy smell, and a dark colour.

Another kind (*East Indian leaf isinglass*) is merely the sac laid open and dried. It is eight or nine inches long, six or seven inches broad, and about three-tenths of an inch thick. A third kind (*East India rolled leaf isinglass*), which I have received from Dr. Royle, appears to have been formed by rolling out the preceding kind into thin plates. One specimen was about eighteen inches long, three inches and a half wide, and one-tenth of an inch thick. Some of the sheets are covered with a thin film of chalk.

Picked East India isinglass, kindly furnished me by Dr. Royle, is in small shreds, two or three inches long, and tapering at the extremities. It is hand-picked in India by the natives. The composition of this isinglass has been ascertained by Mr. Solly, and will hereafter be stated.²

Manilla Isinglass.—A variety under this name has been recently imported. It is called *thin cake*. It is white and clean. It is equal in quality to Brazilian or Samovey book. The fish which yields it is found in the River of Manilla, and on the coasts of the Phillipines, Luconia. Chief mart, Manilla. Price four shillings per pound. It is smaller than the Brazilian; but it greatly resembles the lump Brazilian, and the fish is probably an allied species.³

6. Cod Sounds.—Cod sounds, in the dried state, are brought from Scotland, and used as a substitute for foreign isinglass. They are, however, usually preserved soft by salting, and dressed for the table.

PURITY.—When isinglass is reduced to small shreds (*picked or cut isinglass*), it is scarcely possible to distinguish, by the eye, some of the inferior from the finer kinds. The best criteria are its whiteness, freedom from unpleasant fishy odour, its solubility in water, and translucency of the jelly obtained on cooling from its hot solution. [No sample even of the best isinglass (Beluga or Astrachan leaf) is completely soluble in boiling water. There is always some undissolved residue (albuminous membrane); but this is small in proportion to the goodness of quality. In Beluga, it may form one per cent.; in some kinds of Brazilian, as much as twenty per cent. The reader will find some good remarks by Mr. Redwood on the adulteration of isinglass, in the *Pharmaceutical Journal* for May, 1850, p. 503.—Ed.]

SUBSTITUTION.—Hartshorn shavings and sole-skins (when clean, sweet, and well

¹ Mr. McClelland (*Journal of the Asiatic Society of Bengal*, viii. 203) states that Indian isinglass is yielded by *Polynemus Sele* of Buchanan. But, inasmuch as he obtained only sixty-six grains of isinglass from one of these fishes, while some of the specimens of commerce weigh from half to three-quarters of a pound, it seems tolerably clear that the Indian isinglass of English commerce cannot be obtained from *P. Sele*, but must be procured from some larger fish. It may be the produce of *Polynemus teria*, Buchanan, or the new species of *Polynemus*, referred to by Dr. Cantor (*Journal of the Royal Asiatic Society*, v. 166, London) as the *Salliah* or *Saccolih*.

² For further details respecting East Indian isinglass, see Dr. Royle's work, *On the Production of Isinglass along the Coasts of India, with a Notice of its Fisheries*, London, 1842.

³ Metcalfe, December 1842.

prepared) are sometimes substituted for isinglass in fining. For domestic uses, *patent gelatine* is frequently employed as a substitute for isinglass.

Fig. 433.



False Isinglass from Para (natural size).

7. Para Isinglass.—A substance has lately been imported under the name of Isinglass, which, on examination, proves not to be isinglass, but the dried ovary of a large fish.

Two boxes were imported; they did not contain more than 14 or 16 lbs. A similar article has been before imported into London. It consists of bunches of the size and shape of the subjoined figure. They somewhat resemble a bunch of grapes; and consist of ovoid or rounded masses, attached by peduncles to a central axis; by immersion in water, this axis is found to consist of a convoluted membrane, to one side only of which these ovoid masses are attached.

A very superficial examination of this so-called isinglass proves that it is neither the swimming-bladder of a fish, nor is it gelatinous; but it is in reality the ovary of some large fish, and is of an albuminous nature. When soaked in water, its fishy odour becomes very obvious.

The ovoid masses are *ova*. They are highly vascular on the surface, and are filled with an animal substance of a yellow colour. In general appearance they resemble the vitellus of a shark or ray.

The *Sudis Gigas*, a large osseous fish, upwards of six feet in length, is found at Para. Its flesh is dried, salted, and eaten by the lower classes; and its swimming-bladder constitutes one of the kinds of Brazilian isinglass imported into London. It is probable, therefore, that the ovary of this fish constitutes the false isinglass in question. If not from this fish, it is probably obtained from some allied genus (as *Amia*) of highly organized osseous fishes.¹

¹ [It was during his visit to the Museum of the College of Surgeons for the purpose of examining the preparation to which the preceding plate refers, that the late Dr. Pereira met with the serious accident

GELATINE.—Gelatine may be extracted from bones, by boiling them in water under pressure; or, more readily, by employing bones which have been previously digested in hydrochloric acid to extract the phosphate of lime. In this way a nutritious soup is prepared in Paris for the hospitals, and other pauper habitations.¹ Gelatine has even been extracted from fossil bones. A soup was prepared from one of the bones of the Great Mastodon, by the Prefet of one of the departments of France.

Nelson's Patent Gelatine is obtained from glue-pieces, freed from hair, wool, flesh, and fat.² It is probable that inferior kinds of isinglass are also employed. Two kinds of this patent gelatine are made up: the best (called *gelatine of the first quality*) is opaque; it is, by preference, made from the cuttings of the hides of beasts, or from the skins of calves; the inferior kind (called *gelatine of the second quality*) is transparent; it is made from non transparent glue pieces. Both kinds are sold, cut somewhat in imitation of picked isinglass.

French gelatine is sold in cakes, marked like those of common glue, with the nets on which they have been dried. They are either uncoloured, or coloured red, green, or blue. [Some of this patent French gelatine is made at Paris, from the cuttings of skins used for making white kid gloves.—Ed.]

[A very pure form of gelatine is now extensively sold under the name of *Swinburne's Patent Refined Isinglass*. It is procured from the skins of calves cut into very thin slices, and treated simply with water at or about 200°. No chemical substance whatever is used in its preparation. The skins are treated with successive quantities of water until all the gelatine is extracted. The common sorts of isinglass are treated in the same way, and a very pure kind of colourless gelatine is thus obtained from them, the residues being subsequently boiled up to make glue. The gelatine of the first quality thus procured is white, inodorous, and tasteless, entirely free from acidity or alkalinity. If previously soaked in cold water, it is entirely dissolved without leaving any residue on the addition of a small quantity of boiling water, and the solution on cooling, if not over-heated, sets into a firm transparent jelly. The properties are the same, whether it be procured from calves' skins, or from isinglass. The process simply deprives the isinglass and skins of their insoluble albuminous portions.

The test of the goodness of gelatine is this: When boiling hot water is poured upon it, it should not form a yellow gluey-looking mass of an offensive odour, but it should be colourless, of a thick consistence, and entirely free from smell. The French gelatine is generally run into very thin sheets, in order to conceal the yellow colour. It has no smell when dry, but is very offensive when treated with warm water in the manner above described. A pink or red colour is sometimes given to it in order to conceal its bad quality. The principle, gelatine, is deteriorated by any chemical substance used for its extraction. Gelatine thus prepared, has found its way into the market, and has tended to give an evil reputation to this substance as an article of food and as an economical substitute for isinglass. But it is a well-known fact that isinglass owes its chief properties to *gelatine* alone, and chemistry and the microscope show that when this principle has been once extracted either from skins or fish-bladder, its properties are identical, provided they have not been changed by any chemical process in the extraction. Swinburne's gelatine of first quality is not to be distinguished from the gelatine separated from the air-bladder of the sturgeon. The latter, weight for weight, yields a much larger proportion than the skin of the calf, and the process of extraction is more easy, but the principles are the same; they have the same properties and are adapted to the same uses.

The term Isinglass is probably an English corruption of the German *Hausenblase*—bladder of the Sturgeon. To apply the term isinglass to gelatine extracted from skin is, therefore, not only a misnomer but a mistake. All kinds of isinglass may be regarded as gelatine plus certain impurities or adventitious substances. Gelatine, however, is not isinglass, but the true animal principle separated from these impurities.

Much absurd discussion has arisen as to whether gelatine is to be regarded in the light of a *product* or *educt* of the tissues. It is an educt of the swimming-bladder of the sturgeon, and is properly described by the author (*infra*) as a *constituent* forming from 86 to 93 per cent. of isinglass. If an educt of the air-bladder of the sturgeon, it must be equally an educt of the skin of young animals, as of the calf, i. e. it exists in the skin as such, and is not produced from it by the action of boiling water any more than starch is produced from grain by a similar process. The tissue of the skin is closer than that of the air-bladder; hence it requires a longer continuance of the action of water to separate the gelatine from the other principles. Acetic acid will, however, dissolve gelatine from the skin in the cold, and tannic acid (in tanning skins) com-

which confined him to his bed, and from which he was just recovering, when he was suddenly seized with fatal illness. The above was written while he was confined to his bed, and it was one of the last articles from his pen. It therefore possesses an interest beyond that of the subject to which it relates, and for this reason we have extracted the paragraph from the *Pharmaceutical Journal* for January 1853, in which it was published.—Ed.]

¹ See D'Arcet, *Recherches sur les Substances Nutritives que renferment les Os*, Paris, 1829; also Edwards, *Recherches Statist. sur l'Emploi de la Gelatine*, Paris, 1835; and *Quarterly Journal of Science*, April, 1827.

² See the specification of his patent in *The Mechanic and Chemist* for 1840.

bines with the gelatinous tissue in the cold to form leather. These facts show correctly and truly that gelatine exists in the skin as an independent principle, like albumen.—[Ed.]

COMPOSITION.—Isinglass of fine quality was analyzed by John,¹ who found the constituents to be *gelatine* 70.0, *osmazome* 16.0, *membrane* insoluble in boiling water 2.5, *free acid* (lactic?), with *salts of potash and soda*, and some *phosphate of lime*, 4.0, and *water* 7.0. These results, however, can scarcely be accurate; for dried flesh, as Berzelius² observes, does not contain more than 8 per cent. of osmazome; and if isinglass contained 16 per cent. it could not be kept dry when exposed to the air.

Mr. E. Solly, jun.³ examined three specimens of Bengal isinglass, and found the constituents to be *gelatine*, *albumen*, a small portion of *saline* and *earthy substances*, *osmazome*, and a minute trace of *odorous oil*. The quantities of gelatine in three specimens were respectively 86.5, 90.9, and 92.8 per cent.; while those of albumen were 13.5, 9.1, and 7.2 per cent.

For the following table of the different kinds of isinglass known in the London market, I am principally indebted to Mr. James Metcalfe, wholesale dealer in isinglass, of No. 20, Artillery Place, Finsbury Square.

Country.	Place of Produce.	Place of Export.	Name and Character.	Prices per lb. English.		REMARKS.
Russia	The Oral (Ural)	St. Petersburg . . .	Long Staple Ural, 1st and 2d . . .	14 6	13 6	Very choice and dear.
	The Irtysch and Obi	"	Short ditto, Patriarch		None.	
	Oural and tributaries	"	Ditto, ditto, 1st and 2d book . . .	14 6	13 0	
	Astrakhan . . .	"	Thin leaf, 1st and 2d	14 6 to	9 6	These are the sorts which yield the cut.
	The Volga and tributaries . . .	"	Beluga, 1st and 2d	14 6	10 6	
			Cut by machine } or hand	16 0 to	13 6 to	
			Pickings (the brown ends) . .	14 6	9 6	
	Tributaries of Black Sea . . .	Odessa . .	Sisane leaf . . .	8 0		Refuse of the above.
	Tcherkaskoy . .	Taganrog .	Kroski or Krosky	2 6		Seldom imported.
	The Don and tributaries	"	Samovey Leaf, 1st and 2d	6 0		Seldom inquired for.
Siberia	Ditto	"	Do. Short Staple	3 9	3 3	Used for finings.
				4 0	3 6	In great demand.
				5 0		Seldom imported.
North America	The Irtysch and Obi . .	St. Petersburg . . .	Siberian Purse . .	8 6	7 6	In good esteem.
	Hudson's Bay and rivers . .	Hudson's Bay . . .	Purse	5 6	6 0	A thin insoluble membrane lining the inside. Not in use.
South America	United States . .	New York	Ribbon	No price.		
	The Brazils {	Maranham and Para	Pipe Brazil . .	5 0 to 4 1	3 0	In general demand.
			Lump ditto . .	5 0 to 4 1	3 0	
			Honeycomb do.	3 6	2 0	
East Indies	Bay of Bengal	Calcutta .	Cut Brazil . .	7 6 to 6 6	6 0	Not in much repute.
			Purse			Used perhaps for mixing.
			Leaf	2 0	4 0	Objected to on account of its fishy smell and imperfect solubility. When carefully prepared, it may equal the Brazilian kind.
Scotland	Coasts of Scotland		Picked	3 0	4 0	
			Cods' Sounds . .	1 9 to	1 6 if dry and sweet.	
England	England		Sole Skins . . .	0 10 if clean, sweet, and well prepared.		

¹ Gmelin, *Handb. der Chemie*, ii. 1468.

² Royle, *On the Production of Isinglass*, p. 40, Lond. 1842.

³ *Traité de Chim.* vii. 668.

EFFECTS AND USES.—The *dietetical* properties of gelatine have been already noticed. Considered *medicinally* it is an emollient and demulcent. It is employed, dissolved in water or milk, and rendered palatable by acid and sugar, as a nutritious substance for invalids and convalescents.

A solution of isinglass, with tincture of benzoin, is brushed over black sarcenet to form *Court or Black Sticking Plaster*. *Liston's isinglass plaster* consists of oiled silk coated with isinglass.¹ The preparation of *Gelatine Capsules* has been already described.

Isinglass is also employed as a clarifying or fining agent, (for coffee, wines, beer, &c.) Some of the constituents of these liquors unite with the gelatine, and form soluble compounds, which precipitate, and in the act of precipitation the gelatine incloses within its meshes the matters which rendered the liquid turbid. The great consumers of isinglass are the brewers,² who employ principally the coarse Brazilian variety.

358. OLEUM JECORIS MORRHUÆ.—COD-LIVER OIL.

(*Gadus Morrhua*, L.—*Morrhua vulgaris*, D.)

[*Oleum Morrhuæ*, U. S.]

HISTORY.—The oil obtained from the livers of the Common Cod, and various other allied species of fish, appears to have been for a long period a popular remedy, in various countries of Europe, for rheumatism, and some other diseases, though its use by medical practitioners is comparatively recent. In 1782, it was strongly recommended in chronic rheumatism, by Dr. T. Percival,³ and in 1807, by Dr. Bardsley,⁴ who states that it was in high repute in Lancashire.

ZOOLOGY.—This oil is principally procured from the common cod (*Morrhua vulgaris*; *Gadus Morrhua*), formerly called *Asellus major*;⁵ also from allied species, as the Dorse (*Gadus callarias*), the Coal-fish (*Gadus carbonarius*), the Burbot (*Lota vulgaris*), the Ling (*Lota molva*), and the Torsk (*Brosmius vulgaris*).⁶

Some of the fish-oils⁷ of commerce are obtained exclusively from the liver, others are procured from the adipose tissue diffused through the body of the animal generally. In the former, therefore, we are prepared to find bile-constituents, which are not obtainable from the latter. In fishes, properly so called, the distribution of oil in the body of the animal is not uniform. In the *Gadidæ* or Cod-tribe (common cod, dorse, coal-fish, pollack, turbot, ling, torsk, &c.), in the *Squalidæ* or Sharks, and in some other fishes, almost the whole adipose tissue of the animal is concentrated in the form of oil contained in the liver.⁸ On the other hand, in the salmon, herring, sprat, and wolf-fish, the oil is more diffused through the body of the animal, and the liver is, comparatively speaking, devoid of it. The oils obtained from the livers of the different species composing the tribe *Gadidæ*, appear to be very similar in their physical and chemical qualities, and there is good reason for believing that they agree in their medicinal properties. To all of them the term

¹ *Pharmaceutical Transactions*, i. 145.

² Full particulars respecting the mode of fining beer are given by Jackson, in his *Essay on British Isinglass*, Lond. 1765.

³ *London Medical Journal*, iii. 393.

⁴ *Medical Reports*, p. 18.

⁵ See Schonevelde, *Ichthyologia*, p. 18, Hamb. 1624. Pliny (*Hist. Nat. lib. ix. cap. 28*, ed. Valp.) mentions two kinds of *Asellus*; namely, a smaller kind called *callaria*, and a kind termed *bacchi*, caught in deep water only.

⁶ See Dr. J. H. Bennett's *Treatise on the Oleum Jecoris Aselli*, p. 17, Lond. 1841.

⁷ I use the term *fish-oils* in its popular and commercial acceptance, and include under it not only the oils obtained from fishes properly so called, but also those procured from other aquatic animals, as the *cetacea* and seals.

⁸ Professor Owen in his *Lectures on the Comparative Anatomy and Physiology of the Vertebrate Animals* (Part 1, *Fishes*, p. 242, 1846), observes, "that the myriads of dog-fish captured and commonly rejected on our coasts, show that the fishermen have not yet taken full advantage of this anatomical fact, which exposes to them an abundant source of a pure and valuable oil."

oleum jecoris aselli,¹ *oleum jecoris gadi*, or cod-liver oil,² is indiscriminately applied, though it is commonly used, especially in this country, to indicate the oil procured from the liver of the common cod. (*Gadus morrhua*, Cuv.) It would be better, therefore, to employ the term *oleum jecoris morrhue*, or simply *oleum morrhue*, when it is intended exclusively to designate the latter oil. De Jongh, in his *Disquisitio comparativa chemico-medica de tribus olei jecoris aselli speciebus*, published at Leyden, in 1843, states that the Bergen (Norwegian) oil is principally obtained from three species, viz. the dorse (*Gadus callarias*), the Coal-fish (*Gadus carbonarius*), and the pollack (*Gadus pollachius*), but chiefly from the first.

PREPARATION.—In different countries the mode of preparing the oil varies somewhat. The cod-oil met with in the London market is the produce of Newfoundland, where, according to Pennent,³ it is thus procured: "They take a half tub, and, boring a hole through the bottom, press hard down into it a layer of spruce boughs; upon which they place the livers, and expose the whole apparatus to as sunny a place as possible. As the livers corrupt the oil runs from them, and, straining itself through the spruce boughs, is caught in a vessel set under the hole in the tub's bottom." "At Newhaven, near Edinburgh, the fishermen simply boil the livers in an iron pot, and then filter it [the oil] through a towel containing a little sand." (J. H. Bennett.)

DESCRIPTION.—Among the London dealers, I have met with but one kind of cod-liver oil. Its colour is chestnut-brown, and its odour is like that of boiled cod's liver. It is the *Cod Oil* of commerce, the *oleum jecoris aselli fuscum* of continental pharmacologists. It is extensively used by curriers in dressing leather.

In general, continental writers distinguish three varieties of cod-liver oil; one white or pale-yellow, a second brownish-yellow, a third dark-brown. But between the finest pale-yellow or almost colourless oil, and the dark-brown cod-oil used by curriers, there is an almost infinite variety of shades, so that no absolute difference can be founded on colour only. De Jongh made, in Mulder's laboratory, a very elaborate analysis of three kinds of cod-liver oil, the properties of which he thus describes:—

Three kinds of cod-liver oil are admitted and described by the writer just quoted. These are *pale*, *pale-brown*, and *brown*.

1. *Pale cod-liver oil*.—Golden yellow; odour not disagreeable; not bitter, but leaving in the throat a somewhat acrid fishy taste; reacts feebly as an acid; sp. gr. 0.923 at 63° 5. Fahr. Cold alcohol dissolves from 2.5 to 2.7 per cent. of the oil; hot alcohol from 3.5 to 4.5 per cent.; in either it is soluble in all proportions.

2. *Pale-brown cod-liver oil*.—Colour that of Malaga wine; odour not disagreeable; bitterish, leaving a slightly acrid fishy taste in the throat; reacts feebly as an acid; sp. gr. 0.924 at 63° 5. Fahr. Cold alcohol dissolves from 2.8 to 3.2 per cent. of it; hot alcohol from 6.5 to 6.8 per cent. Ether dissolves it in all proportions.

3. *Dark-brown cod-liver oil*.—Dark-brown, by transmitted light greenish, in thin layers transparent; odour disagreeable, empyreumatic; taste bitter and empyreumatic, leaving behind in the fauces an acrid sensation; reacts feebly as an acid; sp. gr. 0.929 at 63° 5. Fahr. Cold alcohol dissolves from 5.9 to 6.5 per cent. of it; hot alcohol from 6.5 to 6.9 per cent. of it. In ether, it is soluble in all proportions.

¹ Pliny (*Hist. Nat. lib. iv. cap. 28*) states that there were two kinds of fishes called *aselli*, one smaller, termed *callaria*, the other found in deep water, and denominated *bacchi*; the latter were preferred to the former. Varro (*Opera Omnia*, p. 21, Durdrecht, 1619) says that these fishes derived their name *aselli* from their resemblance in colour to the ass. By some later writers the term *asellus* has been extended to several species of the cod tribe—thus, the common cod is called *asellus major*; the ling, *asellus longus*; the coal-fish, *asellus niger*; the whiting, *asellus albus*; the dorse, *asellus striatus*; the pollack, *asellus haifingo*, &c. A few years ago, a writer in one of the medical journals, mistaking the meaning of the word *asellus*, gravely announced that "oil of the liver of the ass" had been introduced as a remedial agent into Germany from Sweden.

² The term *cod-liver oil* is here used to indicate the oil obtained from the livers of any of the cod tribe. In this sense it is about equivalent to the Latin term *oleum jecoris aselli*.

³ Arctic Zoology, iii. 305, 1792.

COMPOSITION.—Cod-oil has been analyzed by several chemists. The following is the analysis of Marder.¹ In 200 grains of the oil he found the following substances:—

In the Clear Oil.		In the Burnt Oil.	
Green soft resin	0.104	(brown resin)	0.130
Brown hard resin	0.026	(black resin)	0.156
Gelatine	0.312		0.936
Oleic acid	111.833		95.000
Margaric acid	20.625		8.000
Glycerine	16.832		18.600
Colouring matter	11.500		25.000
Chloride of calcium	0.1046		0.2092
Chloride of sodium	0.1179		0.1883
Sulphate of potash	0.0361		0.0614
	161.4906		147.6809

Since the above analyses were made, *iodine* and *bromine* have been detected in this oil.

De Jongh found the principal constituents of these oils to be *oleate* and *margarate of glycerine*, possessing the usual properties. But they also contained *butyric* and *acetic acids*, the principal constituents of the *bile* (bilifellinic acid, bilifulvin, and cholic acid), some peculiar principles (among which the substance called *gaduïn*) and not quite one per cent. of *salts*, containing *iodine*, *chlorine*, and traces of *bromine*. Moreover, he found that the oil always contained free *phosphorus*.

The following table shows the proportions of the constituents in the three kinds of oil:—

Constituents.	Pale Oil.	Pale Brown Oil.	Brown Oil.
Oleic acid (with <i>Gaduïn</i> and two other substances)	74.03300	71.75700	69.78500
Margaric acid	11.75700	15.42100	16.14500
Glycerine	10.17700	9.07300	9.71100
Butyric acid	0.07436	—	0.15875
Acetic acid	0.04571	—	0.12506
Fellinic and cholic acids, with a small quantity of mar- garine, oleine, and bilifulvin	0.04300	0.06200	0.29900
Bilifulvin, bilifellinic acid, and two peculiar substances	0.26300	0.44500	0.87600
A peculiar substance, soluble in alcohol	0.00600	0.01300	0.03800
A peculiar substance, insoluble in water, alcohol, and ether	0.00100	0.00200	0.00500
Iodine	0.03740	0.04060	0.02950
Chlorine, and traces of bromine	0.14880	0.15880	0.08400
Phosphoric acid	0.09135	0.07890	0.05365
Sulphuric acid	0.07100	0.08595	0.01010
Phosphorus	0.02125	0.01136	0.00754
Lime	0.15150	0.16780	0.08170
Magnesia	0.00880	0.01230	0.00380
Soda	0.05540	0.06810	0.01790
Iron	—	—	a trace
Loss	3.00943	2.60319	2.56900
Cod-Liver Oil	100.00000	100.00000	100.00000

By reference to this table, there will be observed some slight differences in the composition of the three kinds of oil. Whether these are constant or accidental, farther investigations are required to determine. But from De Jongh's analyses, it would appear that the *pale* oil is richest in oleic acid and glycerine—that the *brown* oil contains the largest amount of margaric, butyric, and acetic acids, and of the substances peculiar to cod-liver oil—and, lastly, that the *pale-brown* oil is richest in iodine and saline matters.

I now proceed to notice in detail some of the substances which enter into the composition of this oil.

1. Of *Gaduïn*.—For the discovery of this substance in cod-liver oil we are indebted to De Jongh. It may be obtained as follows: Saponify cod-liver oil by means of caustic soda, and decompose the soap thus obtained by means of acetate of lead. The resulting lead soap is to be treated with ether, which takes up oleate of lead and gaduïn, and leaves undissolved the margarate of lead. The ethereal solution is dark brown. If it be decomposed by sulphuric acid, brown oleic acid is set free. The brown colour of this acid is owing to the presence of gaduïn. To separate the latter, add excess of caustic acid to the oleic acid, by which oleate of soda is formed. This is insoluble in the excess of caustic soda. It is to be dissolved in alcohol, and the alcoholic solution cooled below 32° Fahr., by which the oleate of soda separates, leaving for the most part the gaduïn in solution. By the addition of sulphuric acid the gaduïn is precipitated from its solution. Gaduïn is a brown substance which is soluble in alcohol, but is rendered insoluble by evaporating its solution to dryness. The alcoholic solution yields, on the addition of neutral acetate of lead, a copious precipitate, composed of C³⁵H²²O, Pb, O. If this lead salt be

¹ Pharm. Central-Blatt für 1837, p. 536.

digested with carbonate of soda, it is decomposed, and a soda salt is obtained in solution, from which sulphuric acid precipitates a brown acid. This, when dried at 288° Fahr., was found to have the following composition: $C^{35}H^{23}O^9$. Gaduin is odourless, tasteless, and of a dark brown colour. It is completely insoluble in water, but is for the most part soluble in both ether and alcohol. Its insoluble portion augments every time the solution is evaporated. When dry, it is brittle and pulverizable. It is insoluble in both nitric and hydrochloric acids. In sulphuric acid it dissolves, and acquires a blood-red colour; but from this solution it is precipitated both by water and alkalis. It is soluble in alkalis. Diffused through water and treated with chlorine, it becomes decolorized. In burning, it yields an odour, first of acetic acid, afterwards of cod-oil, and leaves behind a small quantity of ash.

The insoluble modification of gaduin, to which allusion has already been made, is blackish-brown, pulverizable, insoluble in water, alcohol, ether, and diluted sulphuric acid; but by concentrated sulphuric and hydrochloric acids it is converted into a black powder, without freely dissolving; in hot nitric acid, it gradually and completely dissolves. It dissolves in alkalis, forming a red coloured solution. In burning, it evolves the odour of acetic acid, and leaves about 0.822 per cent. of ashes. When dried at 238° F. its composition is $C^{39}H^{26}O^{12} = C^{35}H^{22}O^8 + C^4H^3O^3 + HO$; that is, gaduin ($C^{35}H^{22}O^8, HO$) combined with acetic acid ($C^4H^3O^3$). But De Jongh's formula scarcely agrees with his experimental result. He says that analysis gave him 7.04 per cent. of hydrogen, whereas his formula indicates about 7.3 per cent.

Berzelius states that, when he read De Jongh's account of gaduin, he was struck with the analogy of the reactions of this substance with those of bilifulvic acid, and he tells us that he was disposed to think that gaduin is primitive bilifulvic acid, and that the reddish-brown substance, insoluble both in alcohol and water, which he (Berzelius) separated from bilifulvin by long and numerous operations, is only the insoluble modification of gaduin. This point, however, at present remains undetermined.

Gaduin is contained in all the three varieties of oil examined by De Jongh. At first, it is yellow, but under the influence of atmospheric air it acquires a brown colour.

2. *Fatty acids; margaric and oleic acids.*—These acids, as obtained from cod-liver oil, do not appear to differ in their nature and composition from the same acids procured from other sources. De Jongh analyzed them in the form of margarate and oleate of lead. The results were as follows:—

Margarate of lead	$C^{34}H^{33}O^3, PbO$.
Oleate of lead	$C^{44}H^{35}O^4, PbO$.

3. *Glycerine.*—This was obtained by saponifying cod-liver oil by caustic soda. The residual lye was decanted from the soda-soap, saturated with sulphuric acid, and the sulphate of soda prepared by crystallization. The residual glycerine was compared with glycerine procured from olive-oil and lead, and found to be darker coloured. All these kinds of glycerine were decolorized by adding basic acetate of lead to the glycerine solution, though they again became coloured when submitted to evaporation.

4. *Bile constituents.*—When cod-liver oil is shaken with water, an emulsion is obtained from which the oil slowly separates. The aqueous liquid becomes clear by filtration. That which had been obtained by shaking the brown oil with water was coloured and empyreumatic; but the other kinds of oil did not colour the water. The liquid invariably had a slightly acid reaction, and the oil which had been shaken with it was clearer, had a feebler odour, and reacted less powerfully as an acid. By boiling the oils with water, the same results were obtained. By evaporation, the aqueous fluids from all the three kinds of oil yielded a reddish-brown extract, which, softened by heat, was slightly soluble in water, was more soluble in ether, and completely so in alcohol. Alkaline solutions dissolved it, and acids threw it down again in the form of a reddish-brown flocculent precipitate. The extracts had a peculiar odour and a bitterish taste. The quantities obtained from the different kinds of oil were as follows:—

	With cold water.	With hot water.
Pale oil	0.607 per cent.	0.513 per cent.
Clear brown oil	0.590 "	0.549 "
Brown oil	1.288 "	1.256 "

When successively treated with ether, alcohol, and dilute spirit, all these extracts yielded the same results.

By ether, a reddish-brown, transparent, glutinous extract was obtained, which melted by heat, stained paper, and had the odour and taste of bile. After some time, small crystals made their appearance in it. It was slightly soluble in water, but readily so in ether as well as in alcohol. A solution of carbonate of ammonia being added to its ethereal solution caused the separation of the mixture into two layers; an upper turbid layer, which by evaporation yielded some drops of *olein*, some crystals of *margarin*, and a *brownish mass* which was identical with that procured by the evaporation of the lower layer. This brown mass had a bitter taste, was separated by water into a soluble and insoluble portion, and consisted of *fellinate* and *cholote of ammonia*.

The extract which had been exhausted by ether yielded to alcohol a blackish-brown, odourless, bitter, shining, hygroscopic mass, which dissolved with difficulty in water, and consisted of *biliverdin*, *bilifulvin*, and *bilifellinic acid*.

Dilute spirit removed from the residual extract a black, shining substance, soluble in alkalies, concentrated sulphuric acid, and hot acetic acid, but insoluble in nitric and hydrochloric acids. From its alcoholic solution, baryta-water and acetate of lead precipitated it of a brown colour. It left no residue by burning.

The residue of the aqueous extract, left after the action of the three above-mentioned solvents, contained an *organic substance* (whose nature has not been determined) and *inorganic salts*, in which chlorine, phosphoric and sulphuric acids, lime, magnesia, and soda were found, but no potash or iodine.

5. *Iodine, bromine, and chlorine*.—Considerable, though, as I conceive, unnecessary, importance has been given to the fact that cod-liver oil frequently or usually contains both iodine and bromine. To the presence of one or both of these substances has been ascribed the whole or part of the remedial efficacy of the oil. A little consideration, however, would be sufficient to prove that their therapeutical agency in the oil must, if any, be exceedingly small. The proportions in which they exist in the oil is inconstant, though in all cases very small. Moreover, beneficial effects have been produced by the use of the oil, which neither iodine nor bromine is capable of producing.

Some chemists have failed to detect *iodine* in cod-liver oil. De Jongh says that it is present in every genuine oil, but that the only certain mode of detecting it is to saponify the oil, and carbonize the resulting soap. He confirms Stein's remark, that neither by immediately carbonizing the oil, nor by saponifying it, and then decomposing the soap by acids, can the iodine be detected. It follows, therefore, that iodine exists in the oil neither in the free state nor in that of metallic iodide, but probably in organic combination, perhaps as an iodic fatty acid. De Jongh determined the proportion of iodine by forming iodide of palladium; every 100 parts of anhydrous iodide of palladium were considered equivalent to 70.34 parts of free iodine.

The largest amount of iodine found in genuine oil is less than 0.5 per cent. If the amount obtained be larger than this, fraud may be suspected. It is said by Dr. Martiny¹ that some dishonest druggists have introduced iodine into the oil for the purpose of augmenting its commercial value. Nay, it is stated that an artificial cod-liver oil has been made by combining iodine with common fish or train oils.

De Jongh detected *bromine* in the oil by Balard's process. The carbonized soap was digested with alcohol, and the alcoholic extract treated with chlorine gas and ether. Its proportion was estimated in conjunction with that of chlorine, as the quantity was too small to admit of accurate separation.

The *chlorine* was determined by precipitating it as chloride of silver from the watery extract of the carbonized soap.

6. *Phosphoric and sulphuric acids*.—*Phosphorus*.—De Jongh determined the presence and quantity of these ingredients in the following way: The oil was saponified by potash, and the soap thus obtained decomposed by hydrochloric acid, by which the fatty acids were separated. From the solution the phosphoric acid was precipitated by a nitrate of iron (whose proportions of oxide was known) and ammonia, and the sulphuric acid by means of nitrate of baryta.

In order to determine the presence and quantity of free phosphorus or sulphur, a given quantity of oil was decomposed by concentrated nitric acid, and the quantity of phosphoric and sulphuric acids in the oxidized liquid ascertained by the above-mentioned method. More phosphoric acid was procured from the oxidized than from the unoxidized liquid, and the proportion of phosphorus was calculated from the excess of acid.

7. *Acetic and butyric acids*.—De Jongh separated these volatile acids from cod-liver oil by adding sulphuric acid to the soda-soap, and distilling the liquid thus obtained. The distilled product had a peculiar odour. It was saturated with barytic water, and evaporated to dryness. One portion of the residue was insoluble in alcohol, the other was soluble. The insoluble salt was acetate of baryta with two equivalents of water ($=C^4H^5O^5, BaO$); the soluble salt was butyrate of baryta. The soluble salt obtained from the pale oil gave the formula $2(C^8H^6O^3), BaO, 6HO$; that procured from the pale-brown sort gave the formula $C^8H^6O^3, BaO, HO$.

Rancid cod-liver oil emits an odour like common fish, or train-oil, and we might, therefore, expect that phocenic acid would be a constituent of cod-liver oil. De Jongh did not detect it; but thinks that phocenic acid may perhaps be resolvable into acetic and butyric acids—a supposition somewhat improbable, seeing that phocenic acid contains considerably more carbon than either butyric or acetic acid. Berzelius observes that the presence of acetic acid in cod-liver oil, in a form which is not extractable by water, is remarkable, because it leads to the supposition that it is contained in the form of a peculiar fat, which would be the acetate of lipule. It will be unnecessary to enter into any details with respect to the other constituents of the oil.

ADULTERATION.—The characters by which we judge of the genuineness, purity, and goodness of the oil, are partly physical, partly chemical.

¹ *Naturgeschichte der für die Heilkunde wichtigen Thiere*, Darmstadt, 1847.

The physical characters which are usually employed are principally colour, odour, and flavour. The finest oil is that which is most devoid of colour, odour, and flavour. The oil as contained in the cells of the fresh liver is nearly colourless, and the brownish colour possessed by the ordinary cod-oil used by curriers is due to colouring matters derived from the decomposing hepatic tissues and fluids, or from the action of air on the oil. Chemical analysis lends no support to the opinion, at one time entertained, that the brown oil was superior, as a therapeutical agent, to the pale oil. Chemistry has not discovered any substances in the brown oil which would confer on it superior activity as a medicine. On the other hand, the disgusting odour and flavour, and nauseating qualities of the brown oil, preclude its repeated use. Moreover, there is reason to suspect that, if patients could conquer their aversion to it, its free use, like that of other rancid and empyreumatic fats, would disturb the digestive functions, and be attended with injurious effects.

Of the chemical characters which have been used to determine the genuineness of cod-liver oil, some have reference to the iodine, others to the gaduin or to the bile constituents. I have already stated that some fraudulent persons are said to have admixed iodine (either free iodine or iodide of potassium) with train-oil to imitate cod-liver oil. The presence of this substance may be readily detected by adding a solution of starch and a few drops of sulphuric acid, by which the blue iodide of starch is produced; or the suspected oil may be shaken with alcohol, which abstracts the iodine.

But though we may thus readily prove that the suspected oil contains no artificially added iodine, the iodine which is naturally contained in, and more intimately combined with the oil, may be frequently recognized by another process. Marchand¹ gives the following directions for detecting it: Saponify the oil with soda, carbonize the soap thus obtained, digest the coal in distilled water, add a drop of starch paste, and subject the mixture to the action of a voltaic battery, the positive pole being placed in contact with the starch paste, the negative pole with the solution. If iodine be present, the starch becomes blue. Marchand states that by this test the iodine can be detected in the urine of a patient soon after he has taken the oil. This, however, is certainly not always correct; for I submitted the urine of a young gentleman, who, for several weeks, had taken with great benefit a tablespoonful of cod-liver oil thrice daily, to the action of a galvanic battery of fifty pairs of plates for several hours, without obtaining the slightest evidence of the presence of iodine.

Sulphuric acid has been employed as a test for cod-liver oil. If a drop of concentrated sulphuric acid be added to fresh cod-liver oil, the latter assumes a fine violet colour, which soon passes into yellowish or brownish-red. Some samples of oil produce at once the red colour, without the preliminary violet tint. Gobley,² who noticed this reaction in the case of oil of the liver of the ray, says, that oil which has been prepared by ebullition in water does not possess this property, but yields with sulphuric acid a clear red colour. This, however, is an error, at least with respect to cod-liver oil. It has been erroneously supposed by some persons that this violet colour was due to the evolution of iodine by the action of the acid on an alkaline iodide contained in the oil. If that were the case, the presence of a little starch-paste would be sufficient to convert the violet into an intense blue colour; which is not the case. The coloration, in fact, depends on the action of the sulphuric acid on some one or more organic constituents of the oil, and the following facts lead me to infer that it is in part due to the presence in the oil of one of the constituents of the bile.

It is well known that, in 1844, Pettenkofer³ pointed out a new test for bile. If to a liquid supposed to contain bile about two-thirds of its volume of oil of vitriol be added, the liquid kept cool, a few drops of a solution of cane-sugar (four or five

¹ *Lehrbuch der Physiolog. Chemie.*

² *Ann. der Chemie und Pharmacie*, B. lii. S. 90, 1844; also *Simon's Chemistry*, translated by Dr. Lay.

ii. 193.

³ *Journal de Pharmacie*, 3me sér. v. 305, 1844.

parts to one of sugar) be added, and the mixture shaken up, a violet-red colour is produced, provided bile be present. This test succeeds very well, if we dissolve a little extract of ox-bile in water, and test the solution with sugar and oil of vitriol. The colour developed agrees with that produced by the addition of oil of vitriol to cod-liver oil, which De Jongh has shown contains the essential constituents of the bile. Pettenkofer remarks that the presence of a very great excess of chlorides will change the violet-red colour into a brownish-red. This fact is deserving of notice, because it may aid in accounting for the fact that some specimens of cod-liver oil strike a brownish-red, not a violet-red colour, with oil of vitriol. Strecker¹ confirms Platner's observation that both cholic and paracholic acids produce the same colour with sugar and oil of vitriol, as bile does; so that Pettenkofer's test doubtless acts on one or both of these acids. Now De Jongh has shown that cholic acid is contained in cod-liver oil, and we have, therefore, good reason for believing that it is in part by the action of oil of vitriol on this acid that the violet-red colour is produced in cod-liver oil.

But it is well known that for the development of this colour in bile it is necessary to use, besides oil of vitriol, a third agent (sugar). Pettenkofer observes that for cane-sugar we may substitute grape-sugar or starch; in fact, any substance which can by the action of oil of vitriol be converted into grape-sugar. No such substance has hitherto been detected in cod-liver oil, and, therefore, it may be said the necessary ingredient to produce this characteristic reaction of oil of vitriol on cholic acid is wanting. Strecker has recently supplied the wanting link. In his valuable paper, to which I have already referred, he observes that acetic acid may be substituted for sugar. To the liquid supposed to contain bile add a few drops of acetic acid, and then concentrated sulphuric acid, when a magnificent purple-red colour is developed. If the quantity of bile be small, it may be necessary to use heat. Now, as cod-liver oil contains acetic acid, we have the requisite agent to enable the oil of vitriol to act on the cholic acid, and the development of the purple or violet-red colour is then readily accounted for. I have already noticed the red colour produced by the action of oil of vitriol on gaduïn (supposed by Berzelius to be derived from the bile). Here, then, is another source for the red colour caused by the action of sulphuric acid on cod-liver oil.

It follows, therefore, from what has been now stated, that oil of vitriol is a test for liver oils. It does not distinguish one liver oil from another, for it reacts equally with the oil of the liver of the ray and with oil of the liver of the common cod. Neither does it distinguish good cod-liver oil from bad, for it produces its characteristic reaction both with common brown cod-oil, and with the finest and palest qualities. But it serves to distinguish oil procured from the liver, from oil obtained from other parts of the animal.

[The experiments of De Jongh go to prove that the active principle of the cod-oil is a substance called by him gadin. Dr. Winckler considers the efficacy of the oil to depend on the presence of oxide of propyle, a substance existing also in ergot of rye, and in the liquor in which herrings are pickled.—Ed.]

Mr. Beasley communicated to the late Dr. Pereira the subjoined method by which he detected iodine in cod-liver oil: To detect iodine in the liquor which accompanies the oil from the liver of codfish, it is sufficient to put a portion of it into a porcelain capsule with a little starch, and add a few drops of a fresh and rather dilute solution of chloride of lime. The characteristic colour manifests itself either immediately or after standing a short time.

The detection of the iodine in the oil was thus effected: 3iiss of hydrate of potash was triturated in a wedgewood mortar with about f3vj of warm water, and f3ij of the oil. The mortar was set in a warm place, and triturated occasionally until the combination appeared complete. The soapy mass was thrown, by portions, into a crucible heated to redness in a common fire, and the heat continued till the soap was calcined. The residuum was triturated with f3ij or less of water, and the mixture thrown on a filter. A portion of the clear lixivium was placed on a capsule with a little starch and nitric acid, moderately diluted, gradually added.

A considerable effervescence takes place, and as soon as the point of saturation is passed the mixture becomes coloured. A considerable excess of acid, however, destroys the colour.

PHYSIOLOGICAL EFFECTS.—At the commencement of its use cod-liver oil frequently causes nausea, disagreeable eructation, and occasionally vomiting. In the dose of a tablespoonful it acts as a laxative, diaphoretic, and diuretic.¹ But Taufflied² declares that, in doses of from two to four spoonfuls a day, he never found it “exert any appreciable influence upon the urine or perspiration, or produce any disturbance in the economy.” The disagreeable flavour of the oil sometimes creates nausea and sickness, but when habit has surmounted the repugnance to it, these effects cease. In several cases it has proved emmenagogue;³ and on some occasions it has given rise to a cutaneous eruption.⁴ Dr. Bardsley found that most persons were disposed to get fat under its use.

USES.—Though it has been used more or less successfully in a considerable number of diseases, the cases in which it has proved most successful are those of a gouty, rheumatic, or scrofulous nature, [and especially in phthisis.—ED.] But even in these it requires a very long-continued use to prove successful. The most recent writer on its employment observes that its use must be continued long, “at least a month, often six weeks, and sometimes for years.” As the oil contains iodine, and as it proves most successful in those maladies in which this element proves successful, it has been suggested that iodine is its active principle. Taufflied, however, denies this, and asserts that the properties of the two are not identical, for the one succeeds where the other fails. Is bromine the active agent?⁵ [It must not be forgotten that iodine and bromine are combined organically with some of the constituents of this oil, and in such manner that they are not to be immediately recognized by the ordinary tests. This fact may perhaps tend to develop a peculiar action of iodine and bromine, and endow them with an efficacy not otherwise attainable.—ED.]

The oil is best adapted for relaxed, torpid, and phlegmatic temperaments, and for scrofulous subjects. In plethoric habits, and where irritation of the stomach and bowels, or inflammation, exists, its use is contraindicated.

Rheumatism, *scrofula*, and *phthisis* are the diseases in which it has proved most successful. In *rheumatism*, it is indicated in the chronic forms of this disease, where the muscles and tendons are rigid, and the joints nearly inflexible. In chronic *gout* it is said not to be so efficacious. In *scrofula*, it has proved successful in most of the forms of this disease, but especially when it affects the bones (as in rickets, caries, &c.), and in *tabes mesenterica*. In the latter intractable form of the disease, its efficacy has occasionally been most surprising. [The experience of the profession at large appears now quite to have established the fact that cod-liver oil is one of the most efficacious of all remedies in arresting the progress of pulmonary phthisis; that it enables patients to struggle on longer against the inroads of the disease, and thus enables them sometimes to obtain cicatrization and contraction of cavities which otherwise must have produced speedy death.—ED.]

The oil has also been employed in some other diseases, with more or less success. In *chronic skin diseases* attention was drawn to its use, some years since, by Dr. Marshall Hall.⁶ In *tinea favosa*, *impetigo*, and *chronic eczema*, it has been found efficacious as a topical application. In *chronic ophthalmia*, especially of a scrofulous kind, it has been given internally, and, in some cases, applied to the eye with benefit. In *paralysis*, also, it has been found beneficial by Schuppmann.⁷

ADMINISTRATION.—For an adult, the dose at the commencement is a tablespoonful, which has sometimes been increased to six times this quantity (!) This

¹ Schenk, *Hufeland's Journal*, Bd. xxii. 1822.

² Bennett, *op. supra cit.* pp. 46 and 47.

³ For an account of Ascherson's speculations on the *modus medendi* of this oil, see Dr. Bennett's *Treatise*, before cited, p. 53.

⁴ *London Medical Gazette*, x. 796.

⁵ For further details respecting the therapeutic uses of this oil, the reader is referred to Richter's *Ausführ. Arzneim.*; Dierbach's *Neuest. Entd. in d. Mat. Med.* p. 270, 1825; and *Ibid.* p. 352, 1837; also Dr. Bennett's *Treatise*, already quoted.

⁶ *London Medical Gazette*, Feb. 28, 1840.

⁷ *Ibid.* pp. 16 and 47.

dose is to be repeated two, three, or four times a day for several weeks, or even months. One patient consumed thirty-six lbs. of oil in two years and a half!! (Taufflied.) Dr. Bardsley gave from ʒss to ʒiiss twice or thrice a day in warm table beer. For children of twelve months or under, the dose is a teaspoonful night and morning. The addition of some aromatic oil (as of lemon, peppermint, cassia, or anise) partly covers the unpleasant taste and smell. It is sometimes taken in the form of an emulsion. Peppermint water and lozenges have been recommended for covering the unpleasant taste of the remedy. [A minute portion of common salt, taken both before and after the dose of oil, will sometimes enable the stomach to bear this remedy when all other devices fail.—ED.]

Class IX. Aves.—Birds.

CHARACTERS.—Vertebrated animals, with red and warm blood, respiring by lungs, and the young of which are produced from eggs. Body covered with feathers, and general conformation organized for flying.

ORDER I. GALLINÆ, *Linnæus*.—GALLINACEOUS BIRDS.

CHARACTERS.—Bill short, convex, in some genera covered by a cere. Upper mandible bending from its base or only at the point; nostrils lateral, covered by a membrane, naked, or feathered. Tarsus long. Three toes before, united at their base by a membrane; hind toe articulated on the tarsus above the junction of the anterior toes.

359. GALLUS BANCKIVA var. DOMESTICUS, *Temminck*.—THE DOMESTIC COCK AND HEN.

Phasianus Gallus, *Linn. E.*

(*Ovi albumen*; *Ovi vitellus*, *L.*—The egg, *E.*—Ovum, *D.*)

HISTORY.—No mention is made of this animal in the Old Testament. Both the male and female are referred to in the New Testament.¹ Aristotle² calls the cock ἀλεκτρον, the hen ἀλεκτροίς.

ZOOLOGY. **Gen. Char.**—Bill of medium size, strong, base naked. Upper mandible arched, convex, bent towards the point. Head surmounted by a crest or plume. Ears naked. Three toes before, united to the first joint; the hind toe raised from the ground. Tarsus with a long and bent spur. Middle feathers of the tail arched. Wings short.

Sp. Char.—Comb dentated. Throat wattled. Feathers of the neck linear and elongated. Body variegated with beautiful colours. Tail compressed and ascending. Comb and wattles of the female less than those of the male.

Some doubt exists as to the origin of our domestic cock and hen. Sonnerat³ affirms that all the varieties originate from the Jungle Fowl (*Gallus Sonnerati*); while Temminck refers them to the Javan Fowl (*Gallus banckiva*).

STRUCTURE OF THE OVARIUM AND DEVELOPMENT OF THE EGG.—The OVARIUM (*racemus vitellorum*) or egg-organ, consists of a cluster of ova, in a hen beginning to lay, about 500 in number. The stalk by which each ovum is attached to the ovary is called the *petiolus*. The size of the ova is exceedingly various; when quite ripe, they are as large as the yolk of an egg; the smaller ones are white, the larger ones yellow. Each ovum, when ripe, is composed of a calyx, the yolk-bag, and the yolk. The calyx constitutes the outer coat or covering of the ovum, and consists of two layers—an outer one, derived from the peritoneum, and an inner one, which is somewhat thicker. Between these two coats the vessels ramify. The *petiolus* is merely a prolongation of the calyx; it is studded with a number of small ova resembling vesicles. On that part of the calyx of a ripe ovum which is opposite the *petiolus* is a whitish curved stripe,

¹ Matthew, xxiii. and xxvi.

² Voyage aux Ind. Orient. ii. 148.

³ Hist. de Animal.

called the *stigma*, indicating the spot where the calyx bursts, to allow the escape of the yolk. The *yolk-bag*, or *membrana propria vitelli*, is within the calyx, and closely invests the yolk. It is a flocculent, delicate, fine coat. In the early stage of the ovum, the yolk is constituted of a pellucid fluid lymph, and is hardly distinguishable from the *vesicula cicatriculæ*. It then becomes whitish, and subsequently yellow, globules of oil making their appearance. In a ripe ovum, it is viscid, tenacious, and of an orange yellow colour; and lies in the calyx, with its long axis towards the petiolus. It is composed of three layers, the middle one having the deepest colour; the innermost inclosing a white fluid called the *albumen centrale* (or *substantia alba vitelli*), from which passes a *little canal* to that part of the surface of the yolk called the *cicatricula*.

The internal surface of the yolk bag is lined with a very thin stratum of globules, in form and figure like those of the blood, but arranged organically. The *cicatricula* or *tread* (as it is improperly called), is formed by an accumulation of these globules forming a mamiform heap, the convexity of which is towards the centre of the yolk, and is usually situated nearer the petiolus than the stigma. In the top of this is the so called pellucid *pore*, which is occupied by a small vesicle discovered by Purkinje,¹ and called by him the *vesicula germinativa*, or *vesicula cicatriculæ*. It is found in all the ovarian ova, and seems to be a natural organ, since it is found in the ova of fowls which have never had access to the male. When the yolk falls into the infundibulum, this vesicle disappears. THE OVIDUCT has some resemblance to a convoluted intestine. It is situated on the left side of the animal. Its superior expanded free extremity is called the *infundibulum*, the edges of which are fimbriated. Inferiorly, the oviduct opens into the cloaca. It is attached to the spine by the *mesometrium*. The *infundibulum*, or expanded portion of the tube, receives the ovum as it escapes from the calyx of the ovarium. The upper part of the ovum is lined by a fine villous membrane, covered with follicles secreting the albumen, or *glaire*, and thrown into a number of longitudinal folds. The first layer of albumen which the ovum receives forms the *membrana chalazifera* of Dutrochet; at either end of which is a soft, pellucid, albuminous nodule, which may be regarded as the *rudimentum chalazarum*. During the descent of the ovum in the oviduct, it receives fresh deposits of albumen; and, as it undergoes spiral rotations in its passage, the above-mentioned processes become curved spirally, and in the perfect egg constitute the *chalazæ*, *grandines*, *appendices albuminis*, or the *poles* or *treadles*. From one chalaza to the other are observed, in many eggs, one or more white striæ, formed by a thickening of the *membrana chalazifera*. Vieq d'Azyr called this appearance the *zona albicans*.

The *albumen*, *glaire*, or *white* of the egg, is not uniform in its consistence. The thickest portion is that which is first deposited around the yolk. Proceeding from without inwards, the three layers of albumen are denominated *albumen primum*, *a. secundum*, and *a. tertium*. Just before the egg arrives at that part of the oviduct called the uterus, it receives its outer coat, the *pellucula ovi*. In the middle, or so-called uterine portion of the oviduct, is formed the *calcareous shell*. Some eggs are expelled without it; these are termed *oon eggs*. The chalk is first deposited in small polygonal pieces, having a crystalline appearance; but, when the deposit has attained a certain thickness, all traces of crystallization are lost.

Hab.—Domesticated in all the four quarters of the globe.

DESCRIPTION.—Eggs (*ova*) are too well known to need much description. Their specific gravity varies from 1.080 to 1.090. By keeping they become lighter, by the evaporation of a portion of the water. Dr. Prout² found that in two years an egg had lost 544 $\frac{3}{10}$ grains. The relative weights of the different parts of the egg are, according to the same authority, as follows: *shell and membrane*, 106.9; *albumen*, 604.2; *yolk*, 288.9; *total*, 1,000. By boiling in water, an egg loses two or three per cent.

1. **EGG-SHELL** (*Testa Ovi*; *Putamen Ovi*).—This consists, according to Prout, of *carbonate of lime*, 97; *phosphate of lime and magnesia*, 1; *animal matter, with traces of sulphur and iron*, 2. The chalk renders the egg absorbent and antacid; hence its use to neutralize the acidity of wines.

2. **PELLICULA OVI** (*Membrana Putaminis*).—An albuminous membrane which lines the shell. It is soluble in alkalies, and from its solution is precipitated by acids. It weighs about 2.35 grains (the whole egg being supposed to be 1,000 grains). At the larger end of the egg it forms the *follicula aeris*; the air of which, according to Bischoff, contains 23.475 per cent. of oxygen.

3. **WHITE OR GLAIRE** (*Albumen seu Album Ovi*) consists of two or three laminæ, which are not homogeneous, as two parts at least are discernible, viz. a solid, probably organized albumen, having the appearance of a very fine delicate membrane, forming a series of cells, in which is contained the liquid albumen. Glaire or white of egg consists, according to Gmelin, of *albumen* 12.0, *mucus* 2.7, *salts* 0.3, and *water* 85.0. According to Dr. Bostock,³ *white of egg* consists of

¹ *Symb. ad ovi avium histor. ante incub.* Lipsiæ, 1830.

² *Philosophical Transactions* for 1822, p. 377.

³ *Nicholson's Journal*, ii. 246.

water 80.0, albumen 15.5, uncoagulable matter 4.5=100.0. The coagulability of albumen by heat, and its incoagulability by acetic acid, distinguish it from caseine. Albumen or glaire (or ovalbumen) is distinguished from albumen of the serum of the blood (*seralbumen*) by its being coagulated by ether. The membranous tissue in which the liquid albumen of eggs is contained is said by Couverbe to be devoid of nitrogen; he calls it *albumenin* or *oonin*.

4. **YELK** (*Vitellus Ovi*) is a kind of yellow emulsion, consisting of oil suspended in water by means of albumen, and inclosed in a sac called the *yelk-bag*. On its upper surface is seen the cicatricula. At the extremities are the twisted flocculent *chalazæ*. The yelk consists, according to Dr. Prout, of yellow oil, with crystallizable fat 28.75, albumen containing phosphorus 17.47, and water 53.8. Dr. Prout¹ says, the yelk of egg consists of water 170.2, albumen 55.3, yellow oil 91.0=316.5. The yellow oil (*oleum ovi*) may be obtained by boiling the yelk hard, and digesting in ether or alcohol, which dissolves the oil. By distilling off the alcohol from the filtered tincture, the oil is left behind.

PHYSIOLOGICAL EFFECTS AND USES.—Both the glaire and the yelk are highly nutritive; the latter, on account of the oil which it contains, is somewhat less easy of digestion than the white. Both are more readily assimilated when in the soft state than when hardened by heat. Considered as medicinal agents, they are emollient and demulcent. The glaire is a valuable agent in the treatment of poisoning by bichloride of mercury, sulphate of copper, and the bichloride of tin. Its efficacy in these cases depends on the combination of the albumen with the oxide or chloride of the metal. [The yelk, as well as the white, exerts antidotal powers, and may therefore be freely used.—ED.] The glaire is also used as a demulcent or sheathing agent in all cases of corrosive or acrid poisons. The yelk is a constituent of the *mistura spiritus vini gallici*. It is also used for preparing emulsions. Its oil has been applied to cracked nipples. The white or glaire is employed as a clarifying agent for wines and some other liquids. Its efficacy depends on its coagulation, by which it entangles in its meshes the impurities with which it either rises to the surface or precipitates. When the liquid to be clarified does not spontaneously coagulate the albumen, it is necessary to apply heat. Bookbinders use the glaire as a varnish.

Class X. Mammalia, *Linnæus*.—Mammals.

CHARACTERS.—*Vertebrated* animals with red and warm blood, breathing through lungs, *viviparous*, and suckling their young with milk formed in their breasts or *mammæ*.

ORDER I. CETACEA, *Linnæus*.—THE CETACEANS.

CHARACTERS.—*Body* pisciform, terminated by a caudal appendage, cartilaginous, and horizontal. Two anterior extremities formed like *fins*, having the bones which form them flattened and very soft. *Head* joined to the body by a very short thick neck. Two pectoral or abdominal *mammæ*. *Ears* with very small external openings. *Brains* large. *Pelvis* and *bones* of the posterior extremities represented by two rudimentary bones lost in the flesh.

360. PHYSETER MACROCEPHALUS, *Lind. L. E.*—GREAT-HEADED CACHALOT.

(Concretum in propriis cellulis repertum, *L.*—Cetine nearly pure, *E.*—Cetaceum, *D.*)

HISTORY.—Cuvier² is of opinion that this animal is perhaps the *Physeter* of Pliny³—the *Orca* of some other Latin writers.

ZOOLOGY. **Gen. Char.**—Inferior *teeth* eighteen to twenty-three on each side of the jaw. *Upper jaw* broad, elevated, without teeth, or with these short and con-

¹ *Philosophical Transactions*, 1822.

² *Hist. Nat.* ix. 3, and xxii. 53, ed. Valp.

³ *Rech. sur les Ossements Foss.* v. 328.

cealed in the gum; *lower jaw* elongated, narrow, corresponding to a furrow of the upper, and armed with thick and conical teeth entering into corresponding cavities in the upper jaw. *Spiracular orifices* united at the upper part of the snout. A *dorsal fin* in some species, a simple eminence in others. *Cartilaginous cavities* in the superior region of the head, filled with *oily matter*.

Sp. Char.—*Lower teeth* twenty to twenty-three on each side, recurved and pointed at the extremity. Small conical teeth concealed in the upper gums. *Tail* narrow and conical. A *longitudinal eminence* on the back above the anus. Upper part of the body blackish or slate blue, a little spotted with white. *Belly* whitish. *Length* forty-five to sixty feet.

The *snout* of the cachalot, notwithstanding its prodigious length, is formed only by the maxillæ on the sides, by the intermaxillæ towards the median line, and by the vomer on this line. The intermaxillæ project to form the anterior part of the snout. Posteriorly, the right one ascends higher than the left. The *spout-hole* is single (in most cetacea it is double), and directed towards the left side, so that whenever the animal spouts water, it is to that side only.

SEAT OF SPERMACETI.—Spermaceti is found in several parts of the body of the animal, mixed with common fat. The head, however, is the grand reservoir for it. Here it is found (mixed with oil) in a large excavation of the upper jaw, anterior to, and quite distinct from, the true cranium which contains the brain. Mr. Hunter¹ states that the spermaceti and oil are contained in cells, or cellular membrane, in the same manner as the fat in other animals; but that besides the common cells there are larger ones, or ligamentous partitions going across, the latter to support the vast load of oil, of which the bulk of the head is principally made up.

There are two places in the head where this oil lies; these are situated along its upper and lower part; between them pass the nostrils, and a vast number of tendons going to the nose and different parts of the head. The purest spermaceti is contained in the smallest and least ligamentous cells. It lies above the nostril, along the upper part of the head, immediately under the skin and common adipose membrane. These cells resemble those which contain the common fat in the other parts of the body nearest the skin. That which lies above the roof of the mouth, or between that and the nostril, is more intermixed with a ligamentous cellular membrane, and lies in chambers whose partitions are perpendicular. These chambers are smaller the nearer to the nose, becoming larger towards the back part of the head, where the spermaceti is more pure.

Mr. Hunter discovered about the nose, or posterior part of the nostril, a great many vessels having the appearance of a plexus of veins, some as large as a finger. On examining them, they were found loaded with spermaceti and oil; and some had corresponding arteries. They were most probably lymphatics, whose contents had been absorbed from the cells of the head.

Hab.—Pacific Ocean, Indian and Chinese Seas. Especially off New Guinea and parts adjacent, Timor, Australasia, Polynesia, Peru, &c.

EXTRACTION OF SPERMACETI.—In the right side of the nose and upper surface of the head of the whale is a triangular-shaped cavity, called by the whalers "the case." Into this the whalers make an opening, and take out the liquid contents (oil and spermaceti) by a bucket. The dense mass of cellular tissue beneath the case and nostril, and which is technically called "junk," also contains spermaceti, with which and oil its tissue is infiltrated.² The spermaceti from the case is carefully boiled alone, and placed in separate casks, when it is called "*head matter*."³

PURIFICATION.—The substance called "*head matter*" consists of spermaceti and sperm oil. Its colour is yellow. Its consistence varies with the temperature. In cold weather it consists of a congealed mass (spermaceti) surrounded and infiltrated by oil. To separate the latter as much as possible, it is put into filter bags. The solid thus obtained is then submitted to compression in hair bags, placed in an hydraulic press. It is then melted in water, and the impurities are skimmed off. Subsequently, it is remelted in a weak solution of potash. It is then fused in a tub by the agency of steam, ladled into tin pans, and allowed slowly to concentrate into large, white, translucent, crystalline masses.

PROPERTIES.—Commercial spermaceti (*cetaceum*; *sperma ceti*) usually contains

¹ *Philosophical Transactions*, lxxvii. 390.

² Beale, *Natural History of the Sperm Whale*, p. 186, 1839; also, F. D. Bennett, *Narrative of a Whaling Voyage round the Globe*, from the year 1833 to 1836, ii. 153 and 228, Lond. 1840.

a minute portion of sperm oil, which is best removed by boiling in alcohol. [The Cetine or pure spermaceti is dissolved, and is deposited on cooling in a crystalline mass. This process should be repeated so long as the alcohol extracts any oil.—ED.] Absolutely pure spermaceti (called *Cetine*) is a white lamellated substance, without taste, and almost odourless. By the addition of a few drops of alcohol or almond oil, it may be reduced to powder. [It is crystalline, has a bright pearly lustre, and melts at 120° . At 670° it is sublimed unchanged.—ED.] It is insoluble in water, and slightly soluble only in alcohol, even at a boiling temperature. [When distilled at a high temperature it is converted chiefly into ethalic or cetylic acid, and *cetène*, a liquid hydrocarbon having the formula $C^{32}H^{32}$. By carefully regulating the temperature these two products alone are formed. When saponified by fusion with caustic potash, it yields cetylate of potash and *ethal* ($C^{32}H^{33}O$) or hydrated oxide of cetyle. No oleate or margarate of potash is produced, as was formerly supposed. According to L. Smith, purified spermaceti or cetine is a cetylate of oxide of cetyle, the oleic acid formerly found being derived from a portion of sperm oil adhering to the spermaceti.—ED.]

COMPOSITION.—The ultimate analysis of pure spermaceti or cetine was made by Chevreul.¹ The proximate composition of the same substance has been ascertained by Dumas and Peligot.²

Chevreul's Analysis.

Carbon	81.660
Hydrogen	12.862
Oxygen	5.478
Cetine	100.000

Dumas and Peligot's Analysis.

Atoms.		Atoms.	
Margaric acid	2	} or {	Margarate of cetine 2
Oleic acid	2		Binoleate of cetine 4
Cetène	3		Water 3
Water	3		
Cetine	1	or	1

[The researches of L. Smith and others have shown that the analysis of Dumas and Peligot must have referred to an impure specimen of spermaceti, *i. e.* a specimen from which the oil had not been entirely separated. The formula of cetine or pure spermaceti, on Liebig's authority, is $(C^{64}H^{64}O^4)$. This corresponds to one equivalent of oxide of cetyle ($C^{32}H^{33}O$) and one equivalent of cetylic acid ($C^{32}H^{31}O^3$). This formula at once explains the products obtained by its saponification and distillation. By distillation at a high temperature, the ethal ($C^{32}H^{33}O$) loses 1 equivalent of water and becomes cetène, while the cetylic acid takes up the equivalent of water, and is distilled over as hydrated cetylic acid.—ED.]

PHYSIOLOGICAL EFFECTS AND USES.—Emollient and demulcent. Internally, it has been employed in irritation and inflammation of the alimentary canal (as diarrhoea and dysentery) and of the bronchial membrane (catarrh); but its internal administration is now nearly obsolete. Its principal medicinal use is in the preparation of cerates and ointments.

ADMINISTRATION.—When employed internally it is generally exhibited in the form of an emulsion (*spermaceti mixture*) made with the yolk of egg. Or it may be made with mucilage.

1. **CERATUM CETACEI**, L. [U. S.]: *Ceratum simplex*, E.; *Unguentum Cetacei*, D.; *Spermaceti Cerate*.—(Spermaceti 3ij; White Wax 3viii; Olive Oil Oj, L.—Olive Oil 6 parts; Bleached Beeswax 3 parts; Spermaceti 1 part, E.—White Wax lbss; Spermaceti lbj; Prepared Hogs' lard lbij, D. "Heat the oil gently, add the wax and spermaceti, stir the whole briskly when it is fluid, and continue the agitation as it cools," E. [Spermaceti 3j; White Wax 3ij; Olive Oil f3vi, U. S.]—If cold oil be added to the wax and spermaceti, the preparation is apt to be somewhat lumpy. As the white wax of commerce is always largely mixed with spermaceti, this preparation has never the precise composition intended by the College. Practically, however, this is of no consequence. The preparation is employed as a mild and simple dressing for blisters and excoriated surfaces.

¹ Gmelin, *Handb. d. Chem.* ii. 440.

² *Ann. de Chim. et de Phys.* lxxii. 5.

2. **UNGUENTUM CETACEI**, L.; *Spermaceti Ointment*.—(*Spermaceti* $\bar{\text{v}}$; White Wax $\bar{\text{xiv}}$; Olive Oil Oj. Having melted them together with a slow fire, stir assiduously until they become cold.)—A softer preparation than the preceding, but used in the same cases.

AMBERGRIS.—The substance called Ambergris (*Ambra grisea*) is procured from the Cachalot or Sperm Whale.¹ In this country it is used as a perfume only; on the continent it is employed in medicine. It appears to be the indurated feces (perhaps somewhat altered by disease) of the animal. Mr. Beale² collected some of the semifluid feces, and found that the dried mass had all the properties of ambergris. It is a solid, opaque, grayish, striated substance, having a pleasant musk-like odour, and which is supposed to be derived from the Squid (*Sepia moschata*) on which the animal feeds; and in support of this opinion it must be mentioned that the horny beaks of this animal are found imbedded in the masses. Its sp. gr. is 0.908 to 0.92. John analyzed it, and found it to consist of a peculiar non-saponifiable fat (*ambreine*) 85, sweet balsamic alcoholic extract, with benzoic acid, 2.5, aqueous extract, benzoic acid, and chloride of sodium 1.5. *Ambreine* is soluble in alcohol, and by the action of nitric acid furnishes a peculiar acid called *ambreic acid*. The effects of ambergris on the system are said to be analogous to those of musk. In the shops is kept an alcoholic tincture (called *essence of ambergris*), which is employed as a perfume only.

ORDER II. RUMINANTIA, Cuvier.—RUMINANTS.

PECORA, Linnæus.

CHARACTERS—No incisors in the upper jaw; in the lower, usually eight; a vacant space between the incisors and molars, but in which, in some genera, are found one or two canines. Molars twelve in each jaw, the crown marked with two double crescents of enamel, of which the convexity is outwards in the lower jaw, and inwards in the upper. No clavicles. *Extremities* disposed for walking. Two toes furnished with hoofs; metacarpal bones united. Four stomachs; intestines long. Two or four inguinal *mammæ*. Horns in the males, and often in the females of most species.

361. MOSCHUS MOSCHIFERUS, Linn. L. E. D.—THE MUSK ANIMAL.

(Concretum in folliculo præputii repertum, L.—Inspissated secretion in the follicle of the prepuce, E. D.)

HISTORY.—Aristotle, Pliny, Ælian, and Oppian, make no mention of this animal. Ætius³ is the earliest writer who notices the perfume. None of the etymologies hitherto given for the word *Musk* (μόσχος) are satisfactory.

ZOOLOGY. Gen. Char.—Incisors $\frac{0}{8}$. Canines $\frac{1}{6}$ — $\frac{1}{6}$. Molars $\frac{6}{6}$ — $\frac{6}{6}$ = 34. Canines wanting altogether in the females; superior canines large in the males. Ears long, pointed. Body slender. Feet with hoofs, separated and enveloping the last phalanges. Tail very short. Two inguinal *mammæ*.

Sp. Char.—Fur of a gray-brown; hair coarse. A pouch before the prepuce of the male, filled with an unctuous musky substance. Size of the roebuck.

The absence of horns and the presence of canine teeth distinguish the animal from the Deer (*Cervus*). The *Styllocerus moschatus* is the connecting link between the deer and the musks. It has the horns of the one, and the canine teeth of the other.

The most interesting part of the musks is the *preputial musk sac*. Cuvier⁴ says no other species of *Moschus* possesses a musk sac; but this statement is not correct. *M. Altaicus*, Eschscholtz (*M. Moschiferus Altaicus*, Brandt), *M. Napu*, and *M. Javanicus*, are also said to possess musk sacs.

¹ Phil. Trans. for 1783, lxxiii. 226.

² Sermon xxvi. t. ii. cap. cxiii.

³ Op. supra cit. p. 135.

⁴ Règne Animal, nouv. édit. i. 259, 1829.

Fig. 434.

Belly of *Moschus moschiferus*.

(From Pallas.)

a. Tail. b. Anus. c. S-rotum. d. Preputial orifice. e. Abdomen. h. Orifice of the musk sac.

Fig. 435.

*Moschus moschiferus*.

ANATOMY OF THE MUSK SAC.—The sac is peculiar to the male animal. If he be supposed to be laid on his back, and the belly examined, we observe behind the navel, and immediately in front of the preputial orifice, a small aperture (*external aperture of the musk sac*) leading into the *musk canal*, which terminates in the cavity of the *musk sac*. The aperture is about half an inch from the umbilicus, and usually about a line, or a line and a half, from the preputial orifice. In some preparations in my possession the distance is much greater. The preputial orifice is somewhat more prominent, and has a number of longish hairs projecting from it, in the form of a brush or hair-pencil; whereas, the external musk aperture is placed in a depression, and is smooth.

The *musk sac* is of an oval form, rather broader at the anterior than at the posterior part. It is flat and smooth above, where it is in contact with the abdominal muscles, but convex below (supposing the animal standing). Its breadth is from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches; its length from 2 to $2\frac{1}{2}$ inches; its depth varies, being greatest anteriorly, where it is about one-half or three-fourths of an inch. The *external aperture* of the musk sac is placed in the median line, but nearer to the anterior than the posterior extremity of the sac. The *musk canal* is about 1 or $1\frac{1}{2}$ lines long, its diameter being about one line. The *internal aperture* of the musk sac is surrounded by fine hairs, which readily fall off, and are found in the musk of commerce. The following are the parts of which the musk sac consists:—

1. *Outer or hairy coat or skin.*—This is a continuation of the hide, and covers the convex portion of the sac.

Its hairs are stiff but smooth, and disposed in a circular manner around the external musk orifice.

2. *Muscular coat.*—This consists of two strata of fibres which surround the sac in a circular form. Pallas¹ states that they arise from the groin, and unite anteriorly with the panniculus carnosus. He regards them as the compressors and retractors of the follicle and of the prepuce when the genital organ is thrust out. The same naturalist has described two retractors of the penis.

Between the two strata of muscular fibres is placed the *penis*, which is remarkable from the circumstance of the urethra projecting beyond the extremity of the glans. In its usual state the penis lies rolled up within the belly.

On the inner surface of the muscular fibres is a number of small oblong or roundish *glands*, compared by Pallas to the Meibomian glands of the palpebræ.

3. *Fibrous coat.*—This is the most external of the proper coats of the musk sac. On its inner surface are numerous depressions or cells, surrounded by ramifying folds, within which the bloodvessels ramify. This coat is continuous (through the musk orifice) with the corium.

4. *Pearly coat.*—A soft delicate membrane, shining like mother-of-pearl. It lines the cells, and covers the folds of the fibrous coat.

5. *Epidermoid coat.*—It is the inner lining of the sac. Its external layer is silvery white; its internal one yellowish or reddish brown.

6. *Musk glands.*—In each of the depressions observed on the internal coat of the musk sac

are found two or more irregular-shaped bodies of a yellowish or reddish brown colour. These bodies consist of a central brownish mass (supposed to be glandular), covered by a fine membrane.

7. *Contents of the Musk Sac*.—Pallas found that, in young animals, the sac was empty and contracted. In the adult animal it contained about a drachm and a half of musk, and in old animals more than two drachms. But these quantities must be below the average, since the dried pods of commerce contain on the average more musk than this. Mr. Campbell¹ describes the musk found in the sac as soft, reddish-brown, granular, and having the appearance of soft gingerbread.²

Hab.—Asia, between 16° and 58° north latitude, and 92° and 155° of east longitude. Especially on the Atlas and Himalayan ranges. China, Cochin-China, Tonquin, Tartary, and Siberia, have all been celebrated for the musk. The animal is timid, and dwells in cold mountainous districts, where coniferous plants abound.

CAPTURE OF THE ANIMALS.—Various methods of catching the animals are adopted. Sometimes they are taken by snares or gins, sometimes by pitfalls, sometimes by shooting them. The Tungouses, one of the native tribes of Siberia, employ the bow and arrow only.

DESCRIPTION.—Three kinds of musk are described, viz: *China*, *Russian* (or *Kabardine*), and *Bucharian*. I am acquainted with the first two only.

1. **China, Tonquin, or Thibet Musk** (*Moschus tunquinensis* seu *tibetanus*).—This is imported in small rectangular boxes (*catties*), about $7\frac{3}{4}$ inches long, $4\frac{3}{4}$ inches broad, and $4\frac{1}{2}$ deep; covered externally by silk, and lined with sheet-lead and paper. These boxes contain about twenty-five sacs or pods, each wrapped separately in paper. On the outside of the lid of some of the boxes is marked *Lingchong Musk*; and on the inside of the lid is a rude Chinese representation of the musk hunters, some shooting the animal, others cutting out the musk bag. On the paper, which envelops each pod, are similar rude representations in blue or red ink.

Pod musk (*moschus in vesicis*) consists of roundish or somewhat oval pods, which are generally broader at one end than at the other. The hairs are brownish-yellow, or grayish or whitish, bristle-like, and stiff; arranged in a concentric manner around the orifice of the sac. A careful examination will always discover the remains of the penis. The pods are about $2\frac{1}{2}$ inches long, and $1\frac{3}{4}$ inches broad. The weight of each pod, as well as of the contained musk, is very variable. I am indebted to Mr. Noakes, druggist, of Snowhill, for the following account of the weight of six pods, and of the grain musk obtained therefrom:—

Pods of Musk.		Weight.		Contents.	
1	$5\frac{1}{2}$	drachms 0 grains	} Grain Musk	16 drachms 15 grains.
1	.....	$4\frac{1}{2}$	" 0 "	
1	.....	8	" $37\frac{1}{2}$ "	
1	.....	9	" $47\frac{1}{2}$ "	
1	.....	5	" 20 "	
1	.....	$3\frac{1}{2}$	" 0 "	
Total	6	37	" 15 "	16	" 15 "
Average	1	6	" $12\frac{1}{2}$ "	2	" $42\frac{1}{2}$ "

Grain musk (*moschus in granis*; *moschus ex vesicis*) is granular, unctuous to the feel, mixed with hairs, of a dark reddish-brown colour, a bitter aromatic taste, and a strong, remarkable, very persistent smell (*musky odour*). Its odour can scarcely be called peculiar, since it is common to several animals and vegetables. Thus, the musk-ox and the musk-cat evolve it. The submaxillary gland of the crocodile secretes an unctuous musky substance. Among plants, *Erodium moschatum*, *Malva moschata*, and *Centaurea moschata*, may be referred to as possessing a musky odour. When mixed with other scents, musk has the remarkable property of augmenting and improving their smell, without much imparting its own; hence it is extensively used by perfumers. A few drops of potash added to musk increases its odour, by setting free, it is supposed, ammonia.

¹ *Journal of the Asiatic Society of Bengal*, vi. 119. Calcutta, 1827.

² For farther details respecting the structure of the musk sac, consult Brandt and Ratzeburg, *Med. Zool.* Bd. 1.

2. Siberian, Russian, or Kabardine (Caberline) Musk (*Moschus sibiricus*, *ros-sicus* seu *cabardinus*). This is an inferior kind. The pods are said to be more oblong or oval than those of the China kind; the hairs longer and whiter. But I have examined large quantities of Siberian musk, the pods of which are not distinguishable from those of the China by any of these characters. The only invariable distinction I have observed is in the scent, which is remarkably different; it is much less powerful, and more nauseous and disagreeable, being somewhat empyreumatic. Geiger says, it is sometimes accompanied by an odour somewhat similar to that of the sweat of a horse. This kind of musk is imported in wooden boxes, and all the pods that I have examined were in a good state of preservation; but frequently, I am told, this is not the case.

BUCHARIAN MUSK (*Moschus bucharicus*) is described by some pharmacologists, but I have never met with it. The hairs are said to be yellowish or reddish-brown. The musk has a weak odour, and is of very inferior quality.

ADULTERATION.—The great sophisticators of musk are the Chinese. I have seen several *artificial* pods of musk which had been imported from Canton. T. W. C. Martius¹ calls this artificial kind *Wampo Musk*, and says that, for some years past, it has been extensively introduced into commerce. The hairy portion of the sacs is formed of a piece of the skin of a musk animal (readily distinguishable by its remarkable hairs), coarsely sown at the edges to a piece of membrane, which represents the smooth or hairless portion of the sacs. These pods are distinguished from the genuine ones by the following characters: the absence of any aperture in the middle of the hairy coat; the hair not being arranged in a circular manner; and the absence of remains of the penis (found in every genuine musk sac). These false sacs, as well as the genuine ones, are sometimes enveloped in papers marked "*Musk collected in Nankin by Jung-then-chung-chung-kee.*" The odour of the musk of the false sacs is ammoniacal.

Grain musk is sometimes imitated by dried blood, and perhaps by other substances. The fraud is to be detected by a careful examination of the appearance and odour of the particles, and by their chemical characters. An infusion of genuine musk gives no precipitate with a solution of bichloride of mercury, but does with tincture of nutgalls, and acetate of lead. By incineration, genuine musk leaves behind a grayish-white ash, whereas blood yields a reddish one. *Artificial musk* is said to be prepared by rubbing in a mortar dried bullock's blood with caustic ammonia, and mixing the half-dried musk with genuine musk.

COMMERCE.—At an average of the three years ending with 1832, the imports of musk from all places eastward of the Cape of Good Hope, with the exception of China, amounted to 4,965 ounces a year.² In 1839, duty (6*d.* per ounce) was paid on 2,389 ounces.

COMPOSITION.—In 1803, Thiemann³ analyzed musk. In 1805, Bucholz⁴ examined it. In 1820, Blondeau and Guibourt⁵ published an analysis of it. Afterwards, Westler,⁶ Buchner,⁷ and Geiger and Reinmann,⁸ submitted it to chemical investigation.

¹ *Lehrb. d. Pharm. Zool.* S. 39, 1838.

² *Berl. Jahrb.* S. 100, 1803.

³ *Journ. de Pharm.* vi. 105.

⁴ *Ibid.* xxii. 152, 1825.

⁵ *M'Culloch's Dictionary of Commerce.*

⁶ *Pfaff, Mat. Med.* iv. 401.

⁷ *Buchner's Rep.* xvi. 222, 1824.

⁸ *Gmelin, Handb. d. Chem.* ii. 1449.

Guibourt and Blondeau.

1. Volatilized by drying	{ Water	46.925
	{ Ammonia	0.325
2. Extracted by ether—Stearine, oleine, cholesteroline, fatty acid with ammonia, traces of a volatile oil		13.000
3. Extracted subsequently by alcohol—Cholesteroline, fatty acid with ammonia, sal ammoniac, chlorides of potassium, sodium, and calcium, and an undetermined acid combined with the same bases		6.000
4. Extracted subsequently by water—Gelatin, carbonaceous matter soluble in water, the preceding chlorides, and an undetermined combustible acid		19.000
5. Extracted subsequently by ammonia—Albumen and phosphate of lime		12.000
6. Fibrous tissue, carbonate and phosphate of lime, hairs, and sand		2.750
		100.000

Geiger and Reinmann.

1. Peculiar volatile substance	{ Quantity undeterminable.
2. Ammonia	Ditto.
3. Peculiar, fixed, uncrystallizable acid	Ditto.
4. Stearine and oleine	1.1
5. Cholesteroline (with some oleine and resin)	4.0
6. Peculiar bitter resin	5.0
7. Osmazome and salts	7.5
8. A mouldy-like substance, in part combined with ammonia and salts	36.5
9. Sand	0.4
10. Water, some volatile odorous matter, the above acid in part combined with alkaline salt, and loss	45.5
	100.0

ODOROUS PRINCIPLE.—Has not hitherto been isolated. The strong and diffusive odour of musk would lead us to expect that its odorous matter was highly volatile. Yet such is not the fact; for we cannot deprive musk of its peculiar odour by distillation, though the distilled liquid has a musky smell. As it is destructible by heat, it is obviously organic. It is not peculiar to musk, since many other substances exhale an analogous odour. Some have suggested that it is the result of putrefaction of one or more of the constituents of musk; and in support of this statement it is asserted that, by Leslie's method of desiccation, musk may be dried and rendered odourless. I have repeatedly performed this experiment with every care, but without obtaining odourless musk. Robiquet was of opinion that many odorous substances owed their odour to a certain quantity of ammonia, which, being disengaged, carried off with it substances not otherwise volatile, which masked the ammoniacal smell. In applying this hypothesis to musk, it must be admitted that it harmonizes well with several of the circumstances observed. Thus, musk evolves ammonia; water distilled from musk contains ammonia; and potash added to a solution of musk heightens its odour (by facilitating the evolution of ammonia?).¹

PHYSIOLOGICAL EFFECTS.—Musk disturbs the functions of the stomach, acts as a stimulant to the vascular system and brain, and afterwards proves narcotic. Jörg² and his pupils submitted themselves to its influence in doses of from 2 to 15 grains in water, or mixed with magnesia. Its primitive effects were eructation, weight at the stomach, diminution or increase of appetite, dryness of the œsophagus, heaviness of the head, vertigo, and headache. The secondary effects were more marked on the encephalon than on the digestive canal; disposition to sleep, faintness, and a feeling of heaviness in the whole body. Lastly, deep and long-continued sleep. In very large doses, the action on the nervous system was very marked; trembling in the limbs, and even convulsions, were observed. The pulse was increased in frequency, and somewhat fuller. These effects show that musk belongs to the cerebro-spinants. It is a stimulant to the nervous and vascular systems, and an irritant to the stomach. Its effects are by no means uniform. Trousseau and Pidoux³ suffered from its use neither excitement of the vascular system nor sleep. Its influence is more manifest in some constitutions (those, for example, commonly termed nervous, in whom there is a very sensible or excitable condition of the nervous system), than in others (as the phlegmatic). Moreover, its effects are more marked in some morbid conditions of the cerebral functions (of the hysterical kind), than in the healthy condition of these functions. In some persons the nervous system appears to be peculiarly susceptible of the odour of musk; for it is reported that headache, giddiness, and even fainting, have been induced by it. When the digestive apparatus is previously in a state of irritation, musk increases the local disorder, giving rise to pain, nausea, vomiting, and diarrhœa. Sometimes the stimulant influence of musk is directed to the sexual organs. Trousseau and Pidoux⁴ experienced from it “une assez vive excitation des organes génitaux.” In the

¹ Even after a century, musk, if originally good, retains its odour. The author examined some, in the possession of Mr. Ince, of the date of 1745, i. e. 100 years old. It was in small cohesive masses, and had a powerful and delightful odour. Is this the kind described as being scarce, and which the animal is said to squeeze out by pressure against stones? Mr. Ince has also some sixty years old—this is very inferior.

² *Material zu einer Arzneimittell.* Leipzig, 1825; and *Lond. Med. Gaz.* xxvi. 932.

³ *Traité de Thérap.* i. 25.

⁴ *Op. supra cit.*

female it has occasionally provoked the catamenial discharge. In persons disposed to epistaxis it has at times appeared to bring on the hemorrhage. Occasionally, diaphoresis or diuresis has seemed to result from its use.

The odorous principle of musk is absorbed, and subsequently thrown out of the system by the excretories. Barbier¹ observes that the urine and the sweat of persons who have taken this substance are powerfully impregnated with its odour—now and then so strongly, that the hand, applied for the purpose of feeling the pulse, retains its odour for some time. On *post-mortem* examination, the brain, and the cavities of the chest and abdomen, in those who have taken it during life, sometimes emit a strong smell of musk. Tiedemann and Gmelin² recognized the odour of musk in the blood of the mesenteric, splenic, and portal veins; but they failed to detect it in the contents of the lacteals. Trousseau and Pidoux mention that, in their experiments, the excretions acquired a feeble odour of musk. Jörg, however, denies that the excretions of those who have taken musk have the smell of this substance.

USES.—The effects of musk, already alluded to, show that it is a remedy which will be useful where we want to excite the nervous system; and, *vice versâ*, that it will be hurtful where there exists a determination of blood to the brain, and in those constitutions denominated plethoric. The cases in which experience seems to have shown that musk is sometimes useful, are the following:—

1. Those diseases which are attended with convulsive movements, and which, therefore, are called *spasmodic*. Such, for example, as hysteria, epilepsy (especially of children, and where the disease does not depend on organic changes, or on plethora), chorea, and even in some cases of tetanus. The employment of musk here has led to its denomination of antispasmodic.

Dr. Cullen,³ on whose practical information I place great reliance, says: “I maintain that musk (when genuine) is one of the most powerful antispasmodics that we are acquainted with. I have found it, with Dr. Wall, to be a powerful remedy in many convulsive and spasmodic affections, and in some of a very peculiar kind. I had once a gentleman affected with a spasm of the pharynx, preventing deglutition, and almost respiration. This, when other remedies had failed, was relieved by the use of musk, which often showed its power; for the disease continued to recur at times for some years after, and was only obviated or relieved by the use of musk.”

2. In *low fevers* which are accompanied with delirium, twitchings of the muscles, a small contracted pulse, and convulsions, musk has been occasionally employed, and with benefit. Like opium, its use in these cases is always uncertain; in one instance relieving, in another increasing the malady, though the cases may be to all appearances parallel.

3. In *retrocedent gout*, as where gout attacks the stomach or the head, giving rise to headache or delirium, musk has been found beneficial. Cullen relates a case where immediate relief was obtained by the exhibition of fifteen grains of genuine musk.

4. In the *delirium* which sometimes occurs in pneumonia, but which bears no relation to the intensity of the latter, and is accompanied with adynamia, Recamier⁴ has found it beneficial.

5. Lastly, during the severe visitation of *malignant cholera*, musk was one of the remedies tried. I saw it employed several times, but without obvious relief. The experience of others was various; but the result is, that the profession has formed a very low estimate of its power in this disease.

ADMINISTRATION.—Musk should be given in *substance*, either in the form of boluses, or suspended in water by means of saccharine or mucilaginous substances.

¹ *Traité Élém. de Mat. Méd.* 2d edit. ii. 143, 1824.

² *Vers. üb. d. Wege auf welch. Subst. ins Blut gelang* S. 63, 69, 71, 73, 1820.

⁴ Jacquet, *Biblioth. Méd.* lix.

³ *Mat. Méd.*

Its dose is from eight to fifteen grains. In children, it may be sometimes used in the form of enema.

ESSENCE OF MUSK. used as a perfume, is ordinarily prepared from the musk pods from which the grain musk has been extracted. The following formula has been furnished me, as one in common use: Grain Musk \mathfrak{z} xiv (or Musk Pods \mathfrak{z} vij); Boiling Water Oss. Digest until cold; then add, of Rectified Spirit Ovjss; Carbonate of Potash \mathfrak{z} ss. Digest.

362. CERVUS ELAPHUS, Linn. L. E.—THE STAG.

(Cornu, L.—Horn, E.)

HISTORY.—Both the hart and the hind (the male and female stag) are repeatedly mentioned in the Bible.¹ The stag is also noticed by Hippocrates, Aristotle, Pliny, Galen, and Avicenna.

ZOOLOGY. **Gen Char.**—*Incisors* $\frac{0}{0}$, *canines* $\frac{0}{0}$ — $\frac{0}{0}$, or $\frac{1}{0}$ — $\frac{1}{0}$, *molars* $\frac{6}{6}$ — $\frac{6}{6}$ =32 or 34. *Canines*, when they exist, compressed and bent back. *Head* long, terminated by a muzzle. *Eyes* large, pupils elongated transversely. *A lachrymal sinus* in most. *Ears* large and pointed. *Tongue* soft. *Body* slender. Four inguinal *mammæ*. *Horns* solid, deciduous, palmated, branched, or simple, in the males; females, with one exception, without horns.

Sp. Char.—*Horns* with three anterior antlers, all curved upwards, the summit forming a crown of snags from a common centre. *Lachrymal sinuses*. *Fur* red-brown in summer, brown-gray in winter. *A pale disk* on the buttocks.

The stag usually begins to shed his antlers in February or March, immediately after which their reproduction begins, and by July he has completely renewed them.² The first sensible phenomenon of the formation of these parts is the vascular excitement about the frontal bone. The arteries are observed to be enlarged,

Fig. 436.



Skull and Antlers of *Cervus Elaphus*.

a. Crown of the antlers with the velvety covering.

and to pulsate more strongly than usual; the heat is increased, and, in fact, all the symptoms of active inflammation come on. Very soon we perceive two cartilaginous tubercles, one on each side; these enlarge and elevate the skin, by which

¹ Deut. xiv. 5; and Psalms, xviii. 33.

² The temporary existence of the antlers shows that they are for a temporary use. The period of their existence, and the stoppage of their growth by castration, points to the sexual functions for their use. No sooner are they fully formed than the males engage in the most deadly fights for the females. In the College of Surgeons are two fine heads with the antlers interlocked—the animals died starved.

they acquire, from the distension of the latter, a velvety covering. These tubercles are soon converted into real bone; but the deposit of ossific matter does not stop here; it continues around the base of the antlers, thus giving rise to what has been usually termed the *burr*. These osseous prominences, the antlers, are supplied with two sets of vessels—an external or cutaneous, which is the most efficient, and an internal. By the pressure made on the former by the burr, they are obliterated; the covering of the antlers no longer receiving a supply of blood, soon ceases to live, dries up, and falls off. The internal vessels continue to keep up the life of the bone for a few months longer, when death takes place. This occurrence may be in part owing to the imperfect nutrition, and partly, perhaps, to the exposure of the bone to the air without any envelop; but it arises principally from some unknown changes in the vital actions. The antlers being now dead, nature soon sets about their separation. To effect this, the living parts at the base are rapidly absorbed, so that the antlers being left but slightly adherent to the frontal bone, readily fall off by a gentle knock. A few hours only elapse before the irregularity on the surface of the os frontis is covered by a thin pellicle, and shortly afterwards the formation of a fresh pair of antlers is commenced. Castration stops the growth of the antlers.

Hab.—Europe, Asia, and North of Africa.

DESCRIPTION AND COMPOSITION.—The antlers of the stag are commonly called *hartshorn* (*cornu cervi vel cornu cervinum*). Though simply designated *cornu* (*horn*) in the London and Edinburgh Pharmacopœia, their composition is very different from that of the horns of the ox or the sheep, and which are sometimes called *true horn*. The latter consists principally of coagulated albumen; whereas, hartshorn has the same composition as bone. According to Merat-Guillot,¹ it consists of *soluble cartilage (gelatine)* 27.0, *phosphate of lime* 57.5, *carbonate of lime* 1.0, *water and loss* 14.5.

Hartshorn shavings or raspings (*rasura velamenta cornu cervi*) readily give out their gelatine by boiling in water.

PHYSIOLOGICAL EFFECTS AND USES.—Decoction of hartshorn is nutritive, emollient, and demulcent. It has been used in intestinal and pulmonary irritation. It is generally taken flavoured with sugar, lemon, or orange juice, and a little wine.

Hartshorn shavings are directed to be used in the manufacture of *Antimonial Powder*, but manufacturers generally substitute bone sawings.

Brewers sometimes employ decoction of hartshorn for fining beer and other liquors. It is preferable to isinglass on account of its cheapness. The gelatinous matter of bones being less soluble than that of antlers, bone sawings or shavings do not answer as a substitute for hartshorn.

CORNU USTUM was formerly a preparation of the Ph. L., but is now removed to the *Materia Medica*, and designated "*Calcis phosphas e cornu igne comparata*."

363. OVIS ARIES, Linn. L. E.—THE SHEEP.

(Sevum [*U. S.*]; Adeps præparatus, L.—Fat, E.)

HISTORY.—The sheep is one of the anciently known animals. It is mentioned by Moses,² by Herodotus,³ Aristotle, and other ancient writers.

ZOOLOGY.—**Gen. Char.**—*Incisors* $\frac{0}{3}$, *canines* $\frac{0}{0}—\frac{0}{0}$, *molars* $\frac{6}{6}—\frac{6}{6}=32$. *Horns* common to both sexes, sometimes wanting in the female, thick, angular, wrinkled transversely, pale-coloured, turned laterally in a spiral form. *Ears* small. *Legs* slender. *Hair* of two kinds. *Tail* more or less short. *Two mammæ*.

Sp. Char.—[*O. Musimom.*]—*Horns* very strong, arched backwards and curved downwards, and towards the point. General colour fawn, more or less brown, white

¹ Quoted by Berzelius, *Traité de Chim.* vii. 643.

² *Thalia*, cxiii.

³ *Genesis*, iv. 2.

on the face and legs, and under the belly; a darker streak on the dorsal line, on the flanks, and often black about the neck.

Fig. 437.

*Ovis Ammon.*

Fig. 438.

*Ovis Musimon.*

The immense number of races of this animal in cultivation are well known; and it is now difficult, perhaps impossible, to determine its native condition. Modern zoologists, however, ascribe our domesticated sheep to *Ovis Ammon*, called the *Argali* of Siberia, or to *Ovis Musimon*, termed the *Mouflon* or *Muflo*n of Sardinia.

Hab.—Domesticated everywhere.

DESCRIPTION.—Mutton suet (*sebum*; *adeps præparatus*) is the fat from the neighbourhood of the kidneys of the animals. It is prepared (*sebum præparatum*) by melting it over a slow fire, and straining through linen or flannel in order to separate the membranous portions.

COMPOSITION.—The ultimate analysis of mutton suet has been made by Chevreul and by Bérard.¹ The first of these chemists also ascertained its proximate composition.

Ultimate Analysis.			Proximate Analysis.	
	Chevreul.	Bérard.		
Carbon	78.996	65.0	Stearine	} principally.
Hydrogen	11.700	21.5	Elaine or Oleine	
Oxygen	9.304	13.5	Margarin, a little.	
			Hircin, a little.	
Mutton suet	100.000	100.0	Mutton Suet.	

PHYSIOLOGICAL EFFECTS AND USES.—Like other fatty bodies, mutton suet is nutritious, but difficult of digestion. Its local effects are emollient and demulcent. In medicine it is used as a basis for ointments, cerates, and some plasters; being preferred, in some cases, to hogslard, on account of its greater consistence.

364. BOS TAURUS, Linnæus.—THE OX.

(Lac.)

HISTORY.—An animal very anciently known and highly valued. It is repeatedly mentioned by Moses.

ZOOLOGY. Gen. Char.—Incisors $\frac{0}{2}$, canines $\frac{0}{0}$ — $\frac{0}{0}$, molars $\frac{6}{6}$ — $\frac{6}{6}$ = 32. *Body* large. *Members* strong. *Head* large; forehead straight; muzzle square. *Eyes* large. *Ears* generally funnel-shaped. A fold of the skin, or *dew-lap*, on the under side of the neck. Four *mammæ*; tail long, tufted; horns simple, conical, round, with different inflections, but often directed laterally, and the points raised.

Sp. Char.—Horns round, lateral arched, with the point turned outwards. *Face* flat, or a little concave. *Occipital crest* in the same line as the base of the horns.

¹ Gmelin, *Handb. d. Chem.* ii. 439.

Mammæ disposed in a square form. *Hair* fawn-coloured, brown or black, not sensibly longer at the anterior than the posterior parts. About seven feet long.

MAMMARY GLANDS two, placed close together, and constituting the *udder*. Each gland consists of a number of *lobes*, made up of *yellowish* or *reddish soft granules*, which consist of very fine bloodvessels, nerves, and the commencement of the *milk* or *lactiferous ducts* (*ductus galactophori*) which unite to form 8 or 10 principal ducts, which open into the *large duct*, or *duct of the teat*. This tube is conical, and has a number of folds on its internal surface.

Hab.—Domesticated everywhere.

DESCRIPTION.—Milk (*lac*), or to be more precise in our description, *cows' milk* (*lac vaccinum*), is an opaque, white, emulsive liquid, with a bland sweetish taste, a faint peculiar odour, and a sp. gr. of about 1.030; the latter property is subject to considerable variation. When recently drawn from the animal it is slightly alkaline. Subjected to a microscopical examination, milk is observed to consist of myriads of *globular particles* floating in a serous liquid. These globules are exceedingly minute; according to Raspail¹ the diameter of the largest does not exceed in size the 0.0003937 (about 1-2500th of an inch). They instantly disappear by solution on the addition of a drop of caustic alkali. Both Donnè² and Sir A. Cooper³ have separated the globules by repeated filtration; the filtered liquor was transparent. The milk globules consist essentially of *butter*. Donnè denies that they contain any caseum, since they are soluble both in alcohol and ether, which do not dissolve caseum. Being specifically lighter than the liquor in which they are suspended, they readily separate by standing. They therefore rise to the surface, carrying with them some caseum, and retaining some of the serum; thus forming what is called *cream*. The milk from which the cream is separated is termed *skimmed milk*.

Cream (*cremor lactis*; *flos lactis*) has a variable sp. gr. The average, perhaps, is 1.0244. The upper stratum of cream is richest in butter, the lowest in caseum. By agitation, as in the process termed *churning*, the fatty globules unite to form *butter* (*butyrum*); the residue, called *buttermilk* (*lac-butyratum*), consists of caseum, serum, and a little butter.

Skimmed milk, like cream, has a variable sp. gr.; perhaps the average may be taken at 1.0348. If left to itself it readily acquires acid properties, while white coagula, commonly termed *curds*, separate from it. If an acid or rennet (an infusion of the fourth stomach of the calf) be added to it, this change is immediately effected. The curd separated by the rennet is called *caseum*. But after rennet has ceased to produce any more coagula, acetic acid will cause a farther quantity to be formed. The curd thus separated by the acid is termed *zieger* or *serai*. The *whey* (*serum lactis*) left after the separation of the caseum and serai, yields on evaporation, sugar of milk, one or more nitrogenous substances, lactic acid, and some salts.

COMPOSITION.—Milk has been the subject of repeated chemical investigation.⁴ The recent analysis of several kinds of milk, published by MM. O. Henry and Chevallier, has been already stated.

The following table shows the composition of several domestic preparations of milk :—

MILK :—			CONSTITUENTS.	
MILK {	Cream {	Butter	{ solid fat { 1. Stearine.	
			{ liquid fat { 2. Butyrine.	
	Buttermilk . .		{ caseum { 3. Oleine.	
			{ serum or whey	
	Skim-milk {	Matters coagu- lable	{ by rennet	4. Caseum.
			{ not by rennet, but by acetic acid	5. Zeiger or Serai.
			{ saccharine matter	6. Sugar of Milk.
			{ azotized matter	7. Osmazome.
	Whey or serum {		{ soluble in alcohol	8. Alkaline and earthy lac- tates and phosphates.
		{ salt	{ soluble in water, not in alcohol	9. Alkaline sulphate and phosphates.
{ insoluble in water			10. Earthy and ferruginous phosphates.	

¹ *Chim. Organ.*

² *On the Anatomy of the Breast*, 1840.

³ *London Medical Gazette*, xiv. 302.

⁴ See Berzelius, *Traité de Chim.* vii. 583.

1. **CASEUM or Casein; Albumen of Milk; Lactalbumen.**—An albuminous substance distinguished from the albumen of the egg and of blood by its not coagulating when heated, by its being coagulated on the addition of acetic acid, and by the products of its spontaneous decomposition. When dried it is yellowish and transparent, like gum; it is odourless, and has a very slight taste. It is soluble in water. If its solution be boiled in contact with the air it becomes covered with a white pellicle insoluble in water. The acids unite to form with it, when they are in excess, insoluble compounds. Various salts (as sulphate of copper, bichloride of mercury, nitrate of silver, bichloride of tin, &c.) form insoluble compounds with it. Its composition has been already stated.

2. **BUTTER.**—This well-known substance consists of three fatty bodies, *stearine*, *elaine* or *oleine*, and *butyrine*. The latter substance is characterized by yielding, by saponification, three volatile, odorous, fatty acids, viz. *butyric*, *capric*, and *caproic acids*. A small quantity of these acids exists in ordinary butter, especially when it has been exposed to the air, and gives butter its peculiar odour.¹

3. **SUGAR OF MILK; Lactin; Saccholactin.**—Obtained from whey by evaporation. As used in commerce it occurs in cylindrical masses, in the axis of which is the cord which serves as the nucleus for the crystals. It is extensively made in Switzerland. Mr. Hess² has shown that, under certain conditions, sugar of milk is susceptible of fermentation, as was before inferred from the fact that the Tartars prepare a vinous liquid, called *Koumiss*,³ from mares' milk. It is gritty under the teeth, and is very slightly soluble in alcohol. It is much less sweet, and less soluble in water, than common sugar. By the action of nitric acid it yields, like gum, saccholactic or mucic acid; so that it forms, as it were, a connecting link between sugar and gum. The composition of it, according to Prout, has been already stated. The formula of crystallized sugar of milk is $C^{24}H^{19}O^{19} + 5 \text{ aq.}$ [Owing to its presence, the oxide of copper is reduced by Trommer's test on boiling milk with sulphate of copper and potash.—ED.]

4. **LACTIC ACID**—This, though stated by Berzelius to be a constituent of milk, is probably a product of its decomposition.

5. **SALTS**—Some of these are soluble in alcohol, as the lactates of potash (principally), soda, ammonia, lime, and magnesia; others are soluble in water, but not in alcohol, as sulphate of potash and the phosphate of potash and soda; lastly, the salts insoluble in water are the phosphates of lime, magnesia, and iron. The latter are held in solution in milk by the caseum principally. Berzelius says by the lactic acid also.

CHARACTERISTICS OF GOOD MILK.—The changes produced in the quality of the milk by diseased conditions of the cow has attracted considerable attention in Paris, owing to the prevalence of a malady called the *cocote*, among the cows in that capital.⁴ The following are the essential morbid changes which have been recognized in milk: want of homogeneousness, imperfect mobility or liquidity, capability of becoming thick or viscid on the addition of ammonia, and presenting, when examined by the microscope, certain globules (agglutinated, tuberculated, or mulberry-like, mucous or pus-globules) not found in healthy milk.⁵ Hence, then, good milk should be quite liquid and homogeneous; not viscid; and should contain an abundance of spherical transparent globules, visible under the microscope, soluble in alkalies and ether; should not become thick when mixed with ammonia; and should form a flocculent precipitate with acetic acid, but not be coagulated by heat alone. The relative quantity of cream afforded by milk is estimated by a graduated glass tube called a *lactometer*. [The test for the purity and goodness of milk is the microscope. By this instrument the number, size, and form of the oil-globules may be determined.—ED.]

I have repeatedly submitted the milk supplied to me by a respectable dealer in this metropolis, to examination by the lactometer, but the results have been most unsatisfactory, as the quantity of cream which I procured varied from 5 to 23 per cent by measure. I have usually found the afternoon's milk to yield less cream than the milk supplied me in the morning. On one occasion, I found 11.5 per cent. of cream in the morning milk, but only 5 per cent. in the afternoon milk. The milk of an Alderney cow yielded 17.5 per cent. of cream.

PHYSIOLOGICAL EFFECTS.—The dietetical properties of milk have been already noticed. As a medicinal agent it is regarded as a demulcent and emollient.

¹ For some remarks on the physical and microscopical characters of butter, by Turpin, see *Journ. de Chim. Méd.* 2nde sér. t. vi. p. 117.

² *Journ. de Pharm.* xxxiii. 498.

³ Clarke's *Travels in various Countries of Europe*, i. 238, Lond. 1810. See also *Transactions of the Royal Society of Edinburgh*, vol. i.

⁴ See *Journ. de Pharm.* xxv. 301-318.

⁵ *Recherches microscopiques sur divers laits obtenus de vaches plus ou moins affectées de la maladie qui a régné pendant l'hiver de 1825 à 1839, et désignée vulgairement sous la dénomination de Cocote*, par M. Turpin, in the *Mémoires de l'Académie Royale des Sciences de l'Institut*, t. xvii. Paris, 1840.

USES.—The *dietetical* uses of milk have been already noticed.

As a *demulcent*, milk is an exceedingly valuable substance in irritation of the pulmonary and digestive organs. It is an excellent sheathing agent in poisoning by caustic and acrid substances, and in some of these cases it acts as a chemical antidote; for example, in poisoning by bichloride of mercury, sulphate of copper, bichloride of tin, the mineral acids, &c. Milk is farther employed on account of its demulcent qualities in the preparation of the bread and milk poultice, which requires to be frequently renewed on account of the facility with which it undergoes decomposition, and acquires acrid qualities.

Milk is a constituent of the *Mistura Scammonii*, E.

Whey is an excellent diluent and nutritive, *Wine whey* (*serum lactis vinosum*) taken warm, and combined with a sudorific regimen, acts powerfully on the skin, and is a valuable remedy in slight colds and febrile disorders. I have already referred to the uses of *cream of tartar whey*, *alum whey*, and *tamarind whey*.

1. **LACTIC ACID.** $C^6H^5O^5 + Aq.$ Symbol= \bar{L} . This acid has been introduced into medicine by Magendie.¹ As it is one of the constituents of the gastric juice, he proposed its use in dyspepsia, and as it is a ready solvent of phosphate of lime, he suggested its employment in phosphatic deposits in the urine. An Italian physician² has more recently recommended it in gout, in consequence of its being a special solvent of the freshly precipitated phosphate of lime. It has been exhibited in the form of lozenges, or in solution in water flavoured with sugar.

2. **OX BILE** (*Fel Bovinum seu Tauri*). Formerly extract of ox bile (*fel tauri inspissatum*) was employed in medicine as a tonic, and it has been recently reintroduced by a few practitioners in dyspeptic cases and biliary derangement. The dose of it is a few grains in the form of pills.

ORDER III. PACHYDERMATA, Cuvier.—THE PACHYDERMS.

ESSENTIAL CHARACTERS.—Three kinds of *teeth*. Four *extremities*, with the toes variable in number, and furnished with strong *nails* or *hoofs*. No *clavicles*. *Organs of digestion* not disposed for ruminating.

365. SUS SCROFA, Linn. L. E. D.—THE HOG.

(Adeps præparatus, L.—Fat, E.—Adeps suillus, D.—Adeps, U. S.)

HISTORY.—The hog is an animal very anciently known. By the Levitical law the Jews were forbidden to eat its flesh;³ on account of either the filthy habits of the animal, or its supposed tendency to engender skin and other diseases, more especially leprosy. The Mahometans are also interdicted from eating it.

ZOOLOGY. **Gen. Char.**—*Incisors*, $\frac{4}{6}$ or $\frac{6}{6}$; *canines*, $\frac{1}{1} - \frac{1}{1}$; *molars*, $\frac{7}{7} - \frac{7}{7}$; = 42 or 44. *Canines* bent upwards and laterally; *molars* tuberculous; lower *incisors* bent forwards. Four *toes* on all the feet, the two middle ones only touching the ground, armed with strong *hoofs*. *Nose* elongated, cartilaginous. *Body* covered with bristles. Twelve *teats*.

Sp. Char.—*Tusks* strong, triangular, directed laterally. No *protuberance* under the eyes. *Colour* blackish-gray in the wild animal, but varying much in the domesticated races.

The varieties of this animal are almost innumerable. They are most conveniently reduced to the following:—

Fig. 439.



Skeleton of *Sus Scrofa*.

a. Foot with five hoofs.
b. Undivided hoof.

¹ *Formulaire pour la préparation et l'emploi de plusieurs nouveaux médicaments*, Paris, 1835

² *British and Foreign Medical Review*, ix. 239.

³ *Levit. xi. 7.*

α. S. Scrofa ferus. The wild hog, or wild boar.

β. S. Scrofa domesticus. The domesticated hog, which varies in its form and colour.

δ. S. Scrofa pedibus monungulis. The hog with solid and undivided hoofs. This variety was noticed by Aristotle and Pliny.

Hab.—The temperate parts of Europe and Asia; the northern parts of Africa; America; the Islands of the South Sea, &c.

PREPARATION.—The fat of the animal is employed in medicine. That about the loins being firmer and denser than the fat of the other parts of the animal, is selected for medicinal use. In order to separate it from the membranes in which it is contained, it is melted over a slow fire, then strained through flannel or linen, and poured while liquid into a bladder, where it solidifies by cooling (*adeps præparatus*). Occasionally salt is added to preserve it; but unsalted lard should be employed for medical purposes. By melting in boiling water, lard may be deprived of any salt which may have been mixed with it. While solidifying, lard should be kept stirred, to prevent the separation of stearine and elaine.

PROPERTIES.—*Hogslard* (*adeps suillus vel porci*) or *axunge* (*axungia*, so called from the use anciently made of it, namely, greasing the axle of a wheel—*unguendi axem*) is at ordinary temperatures a white or yellowish-white solid. Its melting-point varies from 78.5 F. to 87.5° F. In the liquid state it should be perfectly clear and transparent; but if it be intermixed with water it has a whitish or milky appearance. It should have little or no taste or odour. By exposure to the air, however, it acquires an unpleasant odour and acid properties. In this state it is said to be *rancid*. This condition is induced by the oxygen of the air, part of which is absorbed, while a small portion of carbonic acid is evolved. As stearine does not become rancid in the air, while elaine does, the rancidity of lard is referred to the latter constituent. But it has been found that the purer the elaine the less readily does this change occur; whence it is assumed that some foreign substance in the elaine is the primary cause of rancidity, either by undergoing decomposition or by acting on the elaine.

COMPOSITION.—The *ultimate* composition of lard was ascertained by Chevreul,¹ as well as by Saussure and Berard. The first of these chemists also made a *proximate* analysis of rancid lard; and Braconnot determined the composition of fresh lard.

Ultimate Analysis.— Chevreul.	Proximate Analysis of Fresh Lard—Braconnot.	Proximate Analysis of Rancid Lard—Chevreul.
Carbon 79.095	Stearine } 38	Stearine and elaine.
Hydrogen 11.146	Margarine } 38	Volatile non-acid matter having a rancid odour.
Oxygen 9.756	Elaine or Oleine . . 62	Caproic (?) acid.
Lard 100.000	100	Another volatile acid.
		Oleic, margaric, and perhaps stearic acids.
		Yellow colouring matter.
		Non-acid, non-volatile matter, soluble in water.
		Rancid Lard.

PHYSIOLOGICAL EFFECTS.—Lard, like other animal fats, is nutritious, but very difficult of digestion. Its topical effects are demulcent and emollient. Both the flesh and fat of the hog have been long supposed to dispose to cutaneous disease; but it is no easy matter either to prove or disprove this opinion.

USES.—In medicine, lard is principally employed as a basis for unguents. It has been used, by friction, as an emollient; but the practice is now obsolete. In pauper establishments it is sometimes employed, as a substitute for spermaceti ointment, to dress blisters; but the salt which lard sometimes contains, as well as the facility with which this fat becomes rancid, are objections to its use. I have seen it occasion considerable irritation.

¹ Gmelin, *Handb. d. Chem.* ii.

ORDER IV. RODENTIA, *Cuvier*.—THE RODENTS.GLIRES, *Linnaeus*.

ESSENTIAL CHARACTERS.—Two large *incisors* in each jaw, separated from the molars by a vacant space. No *canine teeth*. *Molars* with flat crowns or blunt tubercles. *Extremities*, the posterior longest, terminated by unguiculated *toes*, the number varying according to the species. *Mammæ* variable in number. *Stomach* empty. *Intestines* very long.

366. CASTOR FIBER, *Linn. L. E. D.*—THE BEAVER.

(Castoreum; Folliculi præputii proprio humore repleti, *L.*—A peculiar secretion from the preputial follicles, *E. D.*)

HISTORY.—Castoreum was employed in medicine by Hippocrates, who considered it to have the power of acting on the uterus. It was an ancient opinion that the castor sacs were testicles, and that when closely pursued by the hunter, the animal tore them off, leaving them behind as a ransom.¹ This absurd notion [which is carried out in old plates on beaver hunting] seems to have been long ago disbelieved; for Pliny² tells us that Sextius derided it, and said it was impossible the animal could bite them off, since they were fastened to the spine. Thus was one error confuted by another; the truth being, the testicles are so placed in the inguinal region, on the external part of the *os pubis*, that they are not discernible until the skin is removed. Moreover, female beavers also have castor sacs.

ZOOLOGY. **Gen. Char.**—Incisors $\frac{0}{2}$, canines $\frac{0}{0}-\frac{0}{0}$, molars $\frac{4}{4}-\frac{4}{4}=20$. *Molars* composed of flat crowns, with sinuous and complicated ridges of enamel. Five *toes* on each foot, the anterior short and close, the posterior longer and palmated. *Tail* broad, thick, flattened horizontally, of an oval form, naked, and covered with scales. (Stark.)

Sp. Char.—*Fur* consisting of two sorts of hair, one coarse and brownish, the other downy, more or less gray. About two feet long.

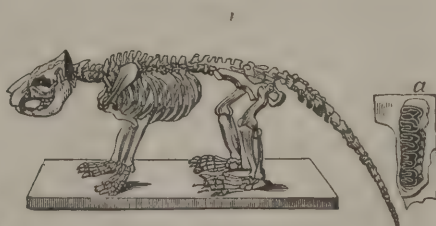
The *ordinary* colour of the animal is brown; but yellow, black, spotted, and white beavers, are met with. The two latter are very rare. Richardson³ has never seen either of them, though he has met with black beavers, which were kept as curiosities. The *tail* is remarkable for its scaly appearance. Its great breadth (oftentimes 5 inches) depends, not on the width of the caudal vertebræ, but on numerous strong tendons inserted into these vertebræ. *Incisor teeth* smooth, orange-coloured anteriorly, white posteriorly.

Fig. 440.

*Castor Fiber.*

b. Scales of the tail.

Fig. 441.

*Skeleton of the Castor Fiber.*

a. Molars of the upper jaw.

¹ Juvenal, *Sat.* xii. v. 34.² *Fauna Boreali-Americana*.³ *Hist. Nat. lib.* xxxii. cap. xiii. ed. Valp.

There is some reason for supposing that the European and American beavers are distinct species. The former are *burrowers*, the latter are for the most part *builders*.¹

ANATOMY OF THE CASTOR SACS.—It has been before stated that both male and female beavers are furnished with castor sacs; hence it will be convenient to consider them in the two sexes separately.

1. *Of the Male Castor Sacs*—If the animal be placed on his back, we observe, near the tail, a hollow (called by some a *cloaca*) inclosed by a large wrinkled, somewhat hairy, cutaneous protuberance, which, according to Perrault,² is easily contracted and dilated, not only by a sphincter, as the anus, but simply like a slit. In this hollow the anus, the prepuce, and the oil sacs open.

When the skin of the abdomen is removed, four eminences, covered by their appropriate muscles, are brought into view. They are placed between the pubic arch and the so called cloaca. The two nearest the pubes are the *castor sacs*, while those next the cloaca are the *oil sacs*. Between the two castor sacs, in the male, lies the *penis* with its bone (*os penis*); it is lodged in a long *preputial canal*, which terminates in the cloaca, and has some analogy to a vagina; so that there is some difficulty to determine, until the skin be removed, whether the individual be male or female.

The penis points towards the tail, not towards the navel, as in the dog. Its surface is covered with longitudinal wrinkles and pits; in each of the latter is found a dark coloured warty-like body. The *testicles*, *vasa deferentia* and *vesiculæ seminales*, present nothing remarkable. There is no *scrotum*. Like most other Rodentia, the beaver has *vesiculæ accessorie*, or blind ducts, which open into the urethra near its commencement. Just at that point where the urethra joins the penis are observed *Couper's glands*. The *castor sacs* open by a common aperture into the preputial canal. This aperture is about one inch in width, and is placed opposite the extremity of the *glans penis* in the relaxed condition of the organ, and about one inch from the orifice of the prepuce. Between this common orifice of the castor sacs and the *glans penis* is a semilunar fold. There is also a second, similar, but thicker fold covering the rectum. The *castor sacs* are pyriform and compressed. They communicate with each other at their cervical portion; but their fundi diverge outwards and towards the pubes. Each castor sac is composed of an *external or cellular* coat which incloses *muscular fibres*. The latter are a continuation of the *panniculus carnosus*; their function appears to be to compress the sac. Within these fibres lies a very *vascular coat*, which covers the scaly or glandular coat, and sends processes in between the convolutions of the latter. The *scaly or glandular coat* forms numerous folds or convolutions, which are largest and most numerous in the fundus of the sac. Externally, it is shining, silvery, and iridescent. Internally, it presents numerous, small, lanceolate, oblong or semilunar scales, which are mostly toothed at their margin, and envelop each a *brown body*, supposed to be a gland, and which is lodged in a small cavity. The inner surface of the castor sacs is lined with *epithelium* (a continuation of the epithelium of the prepuce), which invests the glands and scales of the scaly or glandular coat. In the cavity of the castor sac is found the *castoreum*, which, when recent, is thin, fluid, highly odorous, yellow or orange-coloured, becoming deeper by exposure to the air. The quantity of this secretion is liable to great variation. The *oil sacs* are conglomerate glands, placed one on each side between the castor sac and anus; their ducts terminate in the cloaca. The secretion of these sacs is a fatty matter, having the consistence of syrup or honey, a peculiar odour, and a yellowish colour. It was formerly used in medicine under the name of *pinguedo seu axungia castoris*.³

2. *Of the Female Castor Sacs.*—We are less perfectly acquainted with the anatomy of the female than of the male beaver. Indeed, I am acquainted with three dissections only of the former, viz. one by Gottwaldt, a second by Aegse,⁴ and a third by Mortimer.⁵ The subjoined description is from the memoir of the last-mentioned authority. He says the animal had two *ovaria*, and an *uterus* dividing into two horns (*uterus bicornis*) as in the bitch. The *bladder* lay exactly over the body of the uterus. The *meatus urinarius* ran upon the *vagina* above two inches in length. Just below the *os pubis*, on each side of the *vagina*, above the *meatus urinarius* (supposing the animal laid on her back), a pair of *pyriform bags* were found, about $1\frac{1}{2}$ inch long, and 1 inch broad, diverging at their fundi or broad ends, but approximating most closely at their necks or narrow extremities, which were canals communicating with the adjoining glands. The membranes which formed these bags were tough, wrinkled, and furrowed, of a livid dirty colour. They were hollow, and capable of containing about an ounce of water. Upon opening them, a small quantity of dark brown liquor, like tar, was found, having an odour like castoreum, and in addition a smell of ammonia. It is probable that the emptiness of the sacs, and the unusual quality of their contents, arose from the youth of the animal. About an inch lower, on each side of the *vagina*, were a pair of *glands* (*oil sacs*), each about $1\frac{1}{2}$ inch

¹ See some remarks on the distinctions between the burrowing and building beavers, in *Jameson's Journal*, xxviii. 68.

² *Mem. for a Natural History of Animals*, p. 65, Lond. 1701.

³ For farther details respecting the structure of the castor sacs, consult Brandt and Ratzeburg, *Med. Zoöl.* i.

⁴ Both referred to by Ratzeburg, *op. supra cit.*

⁵ *Philosophical Transactions*, xxxviii. 1735.

long, and $\frac{1}{2}$ inch broad. Their form was oblong but irregular, and having several protuberances externally; their colour was pale flesh, like the pancreas. They seemed to communicate with the castor sacs, the sac and gland on each side opening externally by one common orifice, around which were long black hairs.

Hab.—North America, from 67° or 68° to about 33° north latitude; Europe, from 67° to 36° north latitude, but becoming very scarce. It appears to have been indigenous.

CAPTURE OF THE BEAVER.—The beavers are caught in various ways; sometimes in traps; sometimes in nets; but the usual method is to break up the beaver houses when the animals retreat to their bank holes, where they are easily taken.

COMMERCE.—Castoreum is imported from North America by the Hudson's Bay Company. The greater part of that brought over is sold for exportation. In 1839, duty (6d. per lb.) was paid on 801 lbs.

DESCRIPTION.—Two kinds of castor (*castoreum*) have long been known, viz. Russian and American. The latter, however, is the only one now met with in English commerce.

1. **American Castor** (*Castoreum Americanum*).—It usually consists of two isolated sacs, frequently wrinkled, and which are connected so as to form two parts, like a purse, or like two testicles connected by the spermatic cords. The size of the sacs is liable to considerable variation; they are elongated and pyriform. The penis or the oil sacs, or both, are sometimes attached to them. The colour and other external characters are variable. In December, 1834, I examined between three and four thousand pounds of castoreum, which was offered for sale by the Hudson's Bay Company. A considerable quantity of it was covered externally with a bluish white mouldiness, while the remainder was of a brownish colour. The brown colour, however, varies considerably; sometimes being dark, in some cases yellowish, or even reddish. Some castor sacs are found nearly empty, and present, in their dried state, a very fibrous character; these are of inferior quality. Others are found gorged with unctuous matter, and, when quite dry, break with a resinous character, presenting no fibres until they have been macerated in spirit of wine. In many well-filled sacs the castoreum is quite soft.

In English commerce, two varieties of American castoreum are made; one called the *Hudson's Bay*, the other the *Canadian*. Both are imported by the Hudson's Bay Company. The *Hudson's Bay castoreum* is usually considered the finest variety. The specimens of it which I have examined at the house of the Company, in December, 1834, came from Fort York and Moose River. The finest samples were superior to any of the Canadian kind, though the average quality was much the same.

2. **Russian Castor** (*Castoreum rossicum*).—This is exceedingly scarce. When met with it fetches a very high price. I have paid for a museum sample £2 per oz., while American castor fetched only twenty shillings per lb. There are at least three kinds of castor sold as Russian. *Chalky Russian castor* occurs in smaller and more rounded sacs than the American kind.¹ The specimens of it which I had seen had neither penis nor oil sacs attached. The colour is ash-brown. Its odour is peculiar, empyreumatic, and readily distinguishable from that of the American kind. Under the teeth it breaks down like starch, has at first little taste, then becomes bitter and aromatic. It is readily distinguished from all other kinds by dropping it into diluted hydrochloric acid, when it effervesces like a lump of marble. I have seen another kind of castor from Russia, which may be termed *Resinous Russian castor*. The sacs were large, well filled with resin, did not effervesce with hydrochloric acid, and had an odour very similar to that of American castor. The *Russian castor* described by Guibourt² appears to have been subjected to some preparation.³ [Among the frauds connected with the sale of castor, the author mentions that he examined a pair of "fictitious castor sacs," but found them to be real sacs

¹ See *London Medical Gazette*, xvii. 296, fig. 41.

² See *London Medical Gazette*, xvii. 297, fig. 42.

³ *Journ. de Chim. Méd.* viii. 602.

emptied of their natural contents and stuffed with hay. The coats were thin and membranous.—Ed.]

COMPOSITION.—Castoreum has been subjected to chemical analysis by several chemists. Those whose results deserve especial reference are Bonn¹ and Brandes.²

Brandes's Analyses.

Volatile oil	1.00	Volatile oil	2 0
Resin	13.85	Resin	55.6
Castorin	0.33	Cholesterine	1.2
Albumen	0.05	Castorin	2.5
Osmazome	0.20	Albumen	1.6
Carbonate of lime	33.62	Gelatine	10.4
Other salts	2.82	Osmazome	2.4
Mucus	2.30	Matter soluble in alcohol	1.6
Animal matter like horn	2.30	Carbonate of lime	2.6
Membrane	20.00	Other salts	2.4
Moisture and loss	22.83	Membrane	2.0
Canadian Castor	99.30	Moisture and loss	11.7
		Russian Castor	99.0

These analyses do not agree with my experiments and observations. The quantity of carbonate of lime assigned to Canadian castor is much too large. By incinerating 60 grains of American castor in a platinum crucible I found only 1.2 gr. of ashes, which, if the whole were lime, would be equal to little more than 3.57 per cent. of chalk.

1. **VOLATILE OIL OF CASTOREUM.**—This is obtained by distilling the same water several times with fresh portions of castor. It is pale yellow, and has the odour of castor, with an acrid bitter taste. Bonn says he obtained 34 per cent. of oil; but there must be some error in this statement.

2. **CASTORINE; Castoreum Camphor, Gmelin.**—A crystalline, fatty, non-saponifiable substance. It is fusible, and in the liquid state floats on water. When pure, it is quite white. It is soluble in ether and boiling alcohol. By long ebullition with nitric acid, it is converted into a yellow crystallizable acid, called *castoric acid*. The super castorate of ammonia is crystallizable, and forms white precipitates with the salts of silver, lead, and protoxide of iron, and a green precipitate with the salts of copper. Castorine is obtained by boiling castor in alcohol; the castorine is deposited when the liquor cools. Scarcely any can be got from American castor.

3. **RESIN.**—This is dark brown, has an acrid and bitter taste, and a slight odour of castor. It is insoluble in pure ether, but dissolves readily in alcohol. Water precipitates it from its alcoholic solution.

[In reference to the chemical constitution of Castor, Dr. Pereira made the singular discovery that the aqua castorei contained the hydruret of salicyle. His paper on the subject was published in the *Pharmaceutical Journal* for November, 1851.—En.]

In the year 1844, Wöhler³ remarked that carbolic acid strongly resembled in odour fresh castoreum, and suggested that the volatile oil of castoreum was probably nothing but carbolic acid; and added, that, like the latter substance, it became black by its reaction with chromic acid. Soon after this observation, I endeavoured to verify it by subjecting *aqua castorei*, freshly prepared from good American castoreum, and in which were floating globules of *oleum castorei*, to the action of a solution of chromic acid; but I failed to produce any blackening effect, even at a boiling temperature. It occurred to me, therefore, that probably carbolic acid was not an invariable constituent of castoreum.

In 1848, Wöhler⁴ announced the existence of both carbolic acid and salicine in Canadian castoreum. By subjecting this to distillation with water, he obtained a clear distillate in which small drops of oil were floating, and which possessed a strong odour of castoreum. With sesquichloride of iron it gave distinctly, though feebly, the characteristic reaction of carbolic acid; it became violet, which colour again disappeared in a short time, with a whitish cloudiness precisely like carbolic acid. It was not coloured yellow by ammonia, as is the case with hydruret of salicyle (salicylous acid). In the liquid which was left in the retort, Wöhler detected, after filtration, a benzoate and salicine. On mixing it with muriatic acid, it became turbid, and, in the course of a day, deposited small crystals of benzoic acid. It was also observed that the mother-liquor separated from these crystals contained hydruret of salicyle, for it gave, with sesquichloride of iron, first a deep violet-blue colour, and only afterwards the white cloudiness produced by benzoic acid. In the muriatic solution, from which the benzoic acid had separated, Wöhler detected salicine by the action of chromate of potash and sulphuric acid, which converted it into hydruret of salicyle.

I had occasion to examine the *aqua castorei*, prepared from American castoreum, and was surprised to find that it had acquired the very agreeable odour of the distilled water of the

¹ Quoted by Gmelin, *Handb. d. Chem.* ii. 1449.

² *A. n. d. Chem. u. Pharm.* B. xlix. S. 360, 1844; also *Pharm. Journ.* iv. 186, 1844.

³ *Ann. d. Chem. u. Pharm.* B. lxxvii. S. 360, 1848; also *Chemical Gazette*, vii. 11, 1849.

⁴ *Ibid.*

flowers of meadow-sweet (*spiraea ulmaria*). It no longer contained any traces of volatile oil. On testing it with sesquichloride of iron, it gave at first a violet colour and afterwards a whitish cloud (*benzoate of iron*). With ammonia it became feebly yellow. It was obvious, therefore, that it contained hydruret of salicyl, which must either have been originally obtained by distillation from the castoreum, or have been produced in the *aqua castorei* by some other principle. That it was not originally obtained from the castoreum I have strong grounds for believing; because the *aqua castorei*, when first prepared, had not that agreeable odour which it now possesses, but had the usual castoreum smell, and contained abundance of globules of volatile oil of castoreum. For several years past, in my lectures, I have noticed and described it, and have remarked that, unlike another specimen of *aqua castorei*, which I prepared in 1833,¹ it appeared to me to be losing its proper castoreum odour, and to be acquiring a more agreeable one. During the last twelve months, however, the change of odour has been more marked and rapid than it had been previously, the hydruret of salicyl having been gradually formed in the *aqua castorei*.

As the *aqua castorei*, in which it was formed, was obtained by distillation, it is obvious that the hydruret of salicyl must have been produced from some volatile substance. Now as the water originally contained globules of *oleum castorei*, which have gradually disappeared, and become replaced by the hydruret of salicyl, this oil would seem to be the real source of the last-mentioned substance. However this may be, it can scarcely be doubted that both the hydruret of salicyl and carbolic acid (which Wöhler declares to be identical with *oleum castorei*) are derived from salicine (the presence of which in castoreum has been before stated). As the beaver feeds on the bark of the willow and poplar, we have a ready explanation of the source of the salicine.

Salicine by oxidation readily yields hydruret of salicyl (as by the action on it of a mixture of chromate of potash and sulphuric acid). When it is swallowed, it suffers oxidation, and is excreted in the form of hydruret of salicyl. Professor Liebig informed me that *Chrysomela Populi*, a coleopterous insect which feeds on the leaves of the willow and poplar, excretes hydruret of salicyl; and if allowed to crawl over paper moistened with a persalt of iron it produces a violet-coloured stain. In the human subject, also, salicine suffers a similar change, and is converted into hydruret of salicyl, which passes out of the system in the urine, in which fluid it may be detected by a persalt of iron, which strikes a violet colour with it. Laveran and Millon assert that salicylic acid is also produced, but this is doubtful; for Wöhler and Frerichs found that hydruret of salicyl did not become changed into salicylic acid in its passage through the system. Hitherto, I believe that carbolic acid has not been detected in the urine after the use of salicine; but its presence is by no means improbable, as it is one of the products of the decomposition of the alkaline salicylates.

But to return to the origin of the hydruret of salicyl in *aqua castorei*. It by no means follows that it should be derived from the carbolic acid, but more probably from some other volatile product of the oxidation of salicine. As carbolic acid is a constituent of castoreum, and as it is a powerful agent on the animal economy, it follows that it must be one of the active principles of castoreum. Wöhler and Frerichs found that rabbits, guinea-pigs, and dogs, to which a few drops of carbolic acid diluted with water were administered, constantly died in convulsions in the course of one quarter of an hour; but no important anatomical lesion was discovered in the bodies after death. As castoreum contains but very minute quantities of carbolic acid, it is obvious that should its medicinal activity be found to depend on the latter, a cheap and more effective substitute for castoreum would be found in carbolic acid obtained from coal tar. And here I may observe that carbolic acid and creosote are closely related, if indeed they be not identical, as Laurent and some other chemists suspect.

As the odour of *Hydracem* (see p. 1178) closely resembles that of castoreum, the presence of carbolic acid may be suspected, but no evidence of its presence can be gained by the action of the sesquichloride of iron on either a watery infusion of hydracem, or on the distilled water of this substance.

PHYSIOLOGICAL EFFECTS.—Castor is usually denominated a stimulant and antispasmodic. Since the time of Hippocrates it has been regarded as endowed with a specific influence over the uterus.

In 1768, Mr. Alexander² took it in various doses to the extent of two drachms; and the only effect he experienced from it was disagreeable eructations. In 1824, Jörg and his pupils, males and females,³ submitted themselves to its influence; but the only effects were a slight uneasiness in the epigastric region, and disagreeable eructations having the odour of castor, and which were not allayed by breakfast or dinner, and only ceased at night when sleep came on.

¹ This specimen also contains minute traces of the hydruret of salicyl, as shown by the action of the sesquichloride of iron, as well as of ammonia.

² *Experimental Essays*, p. 83.

³ *Material. zu einer künft. Arzneimittell.* Leipzig, 1824; *London Medical Gazette*, xxvi. 952.

These facts seem to show that castoreum possesses but little medicinal power; yet Dr. Cullen¹ declares that on many occasions it is certainly a very powerful antispasmodic. Its odorous particles become absorbed, for they have been recognized in the urine by their smell.

USES.—Castoreum was formerly in great repute in those affections of the nervous system denominated *spasmodic*; such as hysteria, epilepsy, and catalepsy; more especially when these diseases occurred in females, and were attended with uterine disorder. In those kinds of fever called *nervous*, this medicine has also been recommended. In the northern parts of Europe it is used for its supposed *uterine influence*, to promote the lochial discharge, and the expulsion of retained placenta. It is, however, little employed, partly, perhaps, in consequence of its disagreeable taste and smell, its variable quality, and its high price; but for the most part, I believe, because practitioners consider it an almost inert remedy.

ADMINISTRATION.—It is best given in substance, either reduced to powder or in the form of pill. The dose should be at least ʒij.

1. **TINCTURA CASTOREI**, L. E. [U. S.]; *Tincture of Castor*.—(Castor, bruised, ʒiiss; Rectified Spirit Oij. Macerate for seven days, then press and strain. "This tincture may be prepared either by digestion or percolation, like the tincture of Cassia," E.)—Rectified Spirit, used by the London and Edinburgh Colleges, is a better solvent for castor than proof spirit. The quantity of castor used in the processes is much too small. A fluidounce of the Edinburgh tincture contains three-fourths of a drachm, while the London preparation contains only half a drachm; so that to give a medium dose of castor (ʒj), it would be necessary to administer fʒij of the tincture (rectified spirit) of the London Pharmacopœia! Dr. Paris² says the dose of this tincture is ℥xx to fʒij.—[The *U. S. Pharm.* directs Castor, bruised, ʒij; Alcohol Oij. Macerate for seven days, express and filter through paper.] The tincture of castor made with American castor has a very different odour, is of a much paler colour, and yields a much smaller amount of precipitate on the addition of water, than the tincture of Russian castor.

2. **TINCTURA CASTOREI AMMONIATA**, E.; *Ammoniated Tincture of Castor*.—(Castor, bruised, ʒiiss; Assafetida, in small fragments, ʒx; Spirit of Ammonia Oij. Digest for seven days in a well-closed vessel; strain, and express strongly the residuum; and filter the liquor. This tincture cannot be so conveniently prepared by the method of percolation, E.)—Stimulant and antispasmodic. Spirit of Ammonia is a good solvent for both castor and assafetida.—Dose, fʒss to fʒij.

367. *Hyrax Capensis*.—The Cape Badger.

(Hyraceum, a proposed substitute for Castoreum.³)

HISTORY.—I have received from my friends, Messrs. August Faber and Co., of London, a small sample of this substance, with a note, stating that Hyraceum was a new article, intended as a substitute for castoreum in medicine. They inform me that they believe all that has been imported into Europe as yet, is a dozen tins, of about one pound and a half each, which were sent from the Cape of Good Hope (the place of production) to Hamburg, and there sold at about eight shillings each. The tins were of a cylindrical shape, and the hyraceum contained in each was in one mass, adhering to the tin without any other protection. As this substance is a very remarkable one, and is scarcely known even by name in this country, I subjoin a short notice of it, and of the animal which yields it.

The name *hyraceum* was first applied to this substance by Dr. Edward Martiny,⁴ in 1847. It is derived from *Hyrax*⁵ (the generic name of the animal yielding this substance), and bears the same relation to this latter word that castoreum does to castor. By the Dutch colonists, this substance has been erroneously called *Dassen-piss*, under the mistaken notion that it was the urine of the *Dasse* (the name by which the animal is known at the Cape).

¹ *Mat. Med.*

² From a paper by the author in the *Pharmaceutical Journal*, September, 1850.

³ *Naturgeschichte der für die Heilkunde wichtigen Thiere*, p. 119.

² *Pharmacologia*.

⁴ The word "hyrax" is derived from ὑράξ, which Nicander (*Alexipharmaca*, 37) uses to signify the shrew-mouse.

ZOOLOGY.—The animals referred by zoologists to the genus *Hyrax*, and called by French zoologists *Damans*, possess remarkable interest to the naturalist, on account of the importance of anatomy to the accurate determination of their position in a natural classification. For a long period they were placed among the *Rodentia*, to which in size and general appearance they bear some resemblance. But Cuvier showed that, by their organization, they really belong to the *Pachydermata*, being, with the exception of the horn, little else than rhinoceroses in miniature; at least, they have quite similar molars, but the upper jaw has two stout incisors, curved downwards, and, during youth, two very small canines, the inferior four incisors, without any canines. The dental formula of the genus, therefore, is as follows: incisors $\frac{2}{1}$, canines 0, molars $\frac{7}{7}$ — $\frac{7}{7}$ =34. The animals have four toes to each of their fore-feet, and three to the hind-feet, all, excepting the innermost posterior, which is armed with a crooked and oblique nail, terminated by a kind of very small, thin, and rounded hoof. The body is covered with thick hair, and beset here and there with erinaceous bristles. They have a simple tubercle in place of a tail, short muzzle and ears, and six teats, two pectoral, and four ventral.

The *Hyrax capensis*, Cuvier, the *Cavia capensis* of Pallas, and some other writers, was considered by Cuvier to be identical with the *Hyrax Syriacus*—the *Coney* of Scripture.¹ It is about the size of a large rabbit; with soft hairs, grayish, or ashy-brown above and paler beneath. Along the back is a dark band or stripe, with a blackish spot in the middle. The head is thicker, and the mandible or lower jaw higher than in other species. Vertebrae from forty-eight to fifty. Ribs twenty-one to twenty-two. Space between the incisor and molar teeth small. Interparietal bone large and three-angled.

Thunberg² alludes to the popular notion at the Cape, that these animals menstruate. "In the crevices of the mountains, a great number of *dasses* (*Cavia capensis*) were found, which were generally supposed to have the menstrual flux." In another passage,³ he says he "was shown a kind of bitumen, which the country people supposed to be the inspissated urine of the great mountain rat (*Cavia capensis*) that is found there. I was informed," he adds, "that this bitumen was to be found in great abundance in the cracks and crevices of the mountain, especially at one large projecting *krants* or summit."

Sparman⁴ notices the animals which the natives call *dasses* or *badgers*. "These creatures," he observes, "which have some affinity with the ordinary marmots, and are about the same size, are eaten by many people, who look on them as a delicacy. They are likewise easily made tame, and are found in many other places in the African mountains. The little *Dassen islands* on the western coast of Africa take their name from them. On these places in the mountains where these creatures dwell, there is found a substance, called here, *dassen-piss*. It resembles petroleum, or rock oil, and by many that have seen it is actually considered as such. It is likewise used by some people for medical purposes, and by them is supposed to have greater powers than is consistent with any degree of probability. Finding that this substance did not stand the same proofs as petroleum, and at the same time that it was found only in places frequented by the *dasses*, I had sufficient reason to conclude that it proceeded from this animal, and that it is most probably the menstrual excretion of this creature, as observations made on tame females of this species have given room for such a suspicion; and as, besides, the *dass's* excrements are often found in this substance, and seldom anywhere else."

Professor Lichtenstein informed Schrader, that "this substance is found in small separate pieces on rugged mountainous declivities, chiefly in those districts where the *Hyrax capensis* is most frequently found. The colonists collect these pieces, which, when fresh, are soft and somewhat glutinous, and press them together in large masses, in which state the volatile constituents are better preserved. They employ it medicinally, either in the form of powder, or infused in wine, in many diseases, especially in hysterical complaints, in which it frequently acts in a surprisingly beneficial manner."

"The Hottentots," says Buffon,⁵ "highly prize a kind of medicine, which the Dutch call *badger's urine* (*pissat de blaireau*). It is a black dry substance, which has a very bad smell, and is found in the crevices of the rocks, and in caverns. They say it is derived from the urine of these animals, who always pass it in the same spot. The urine deposits this substance, which, becoming dry by time, acquires some consistence. This," adds Buffon, "is very probable; for the animal at Amsterdam, almost always passed his water in the same corner of the cage in which he was confined."

In the published accounts of the dissections of this animal, no glandular structure, such as we must suppose would be required for the secretion of hyraceum, is mentioned. Mr. Quekett writes to me that, having examined a portion of the specimen which I gave him, he believes it "to be composed entirely of excrement, and not, like castoreum and musk, the secretion of a gland; for I find," he adds, "that the *hyrax capensis* has no anal or other glands."⁶ But it deserves to be especially noticed that dissections of *male* animals only have been published; while the remark of Sparman would lead us to suspect that the secretion is peculiar to the female.

¹ *Leviticus*, xi. 5; *Psalms*, ciii. 18.

² *Travels in Europe, Asia, and Africa, between the years 1770 and 1779*, i. 165.

³ *Voyage to the Cape of Good Hope*, i. 309, 1786. ⁴ *Histoire Naturelle*, Supplement, t. vi. p. 280, 1782.

⁵ *Ibid.* i. 166.

⁶ [Mr. Quekett could detect no trace of any glands likely to produce the hyraceum.—Ed.]

Farther observations respecting the anatomical structure of the animal are required ere we can arrive at any satisfactory conclusion respecting the origin of hyraceum. My friend, Mr. Thomas Bell, Sec. R. S., who some years since had in his possession a living full-grown male animal (the one which was subsequently dissected by Professor Owen), tells me that his specimen had no peculiar smell, nor did he perceive any peculiar gland on examination after death.

Pallas¹ notices, as unusual and anomalous in the structure of the animal, the mode of insertion of the ureters into the fundus of the bladder. Professor Owen notices, and somewhat corrects this description.² For what purpose this structure is designed in the hyrax, or whether the urine undergoes any change in consequence of it, Mr. Owen could not conjecture, but he alluded to the alleged medicinal qualities of this secretion.

Sparman's opinion receives no support from the physical and chemical examination of the specimen in my possession.

Dr. Krauss, of Stuttgart, who resided for a long time at the Cape, says, that most of the colonists regard it as a secretion which appears with the catamenia.

Dr. Edward Martiny,³ who reports this, adds, "that its occurrence at the rutting season gives great weight to this opinion. I regard hyraceum," he continues, "as a secretion connected with the sexual functions, and produced by highly developed preputial and probably also vaginal glands, as in the beaver; but with this difference, that while in the beaver we know not whether this secretion is at times evacuated, in the hyrax it is very probably actually excreted. For we find it in considerable quantities in those places where the animals are met with; a fact explained by the circumstances that the animals at the Cape usually live in herds. Dr. Krauss writes to me, that it is especially found in the fissures of the variegated sandstone of many mountains in the colony, especially in Kokinansklof and Franche Hoek, and may be collected there in extraordinary quantity. In proof of this, it may be mentioned that, some years ago, Professor Püppig, of Leipzig, received from the Cape some bird-skins, stuffed with hyraceum to preserve them. So that it must be met with in considerable quantity, and at a low price, and might, therefore, be obtained as an excellent substitute for the more costly castoreum."

PROPERTIES.—Hyraceum, such as I have received it, is a tolerably hard solid substance, which breaks with considerable difficulty; and has a blackish brown colour, a glistening or resinous appearance in places, which have a somewhat glutinous feel. It has a moderately strong odour, which greatly resembles that of Canadian castoreum. In taste, also, it is like the latter substance. [Its specific gravity is from 1.422 to 1.5.] When heated in the flame of a candle, it evolves a castor-like odour, swells up, burns, and leaves behind a spongy coal, with a whitish ash on the apex. From the yellow colour which it communicates to the outer cone of the flame, it manifestly contains sodium or soda, and from the intense white light which the ash on the apex of the coal evolves, it obviously contains lime (?). Water dissolves a considerable portion of it. Boiled in alcohol, it communicates a feeble colour to this liquid. By boiling in water, it evolved a smell similar to that of castoreum, and yielded a decoction which was of a dark yellowish-brown colour, and very feebly restored the blue colour of reddened litmus paper. When submitted to dry distillation in a test-tube, it evolved, first, an odour of castoreum, then a dense white empyreumatic smoke, which communicated a blue colour to reddened litmus paper, thereby indicating the presence of ammonia. Hyraceum has been submitted to a careful microscopic examination by myself as well as by my friends Dr. Sharpey and Mr. John Quekett. Vegetable tissues (epidermis, cellular tissue, woody fibre, ducts and spiral vessels), animal hairs, and siliceous sand, have been found in it. Mr. John Quekett observes that "spirit and caustic potash appear to have little or no action on it; but they bring out a few epithelium scales, principally of the scaly variety." I could detect no blood disks. Dr. Sharpey also observes that he "saw nothing which could for a moment be taken for blood particles or the remnants of blood particles." He observed globular particles, perhaps, either resinous or oily; and at least two kinds of vegetable epidermis, one apparently from a gramineous plant. The animal hairs were short fragments, very fine, and by no means numerous.

As the hyraceum which I have received contains vegetable remains, and probably, therefore, is contaminated with the excrement of the animal, I was anxious to know what kind of fecal matter is discharged from the bowels. Pallas says that the "*scybalia in ultimo intestino erant molliculosa, fusco-lutea.*" Dr. Andrew Smith, author of the *Illustrations of the Zoology of South Africa*, tells me that the feces are in little balls, something like rabbit's dung. He also informs me that, in the places where the animals live at the Cape, the feces occur in heaps, while the hyraceum is found in the crevices of the rock, as if it had run off in a liquid state, from which he inferred that it was a product of urine and excrement.

COMPOSITION.—Schrader⁴ submitted hyraceum to chemical examination, and found its constituents to be as follows:—

¹ *Spicilegium Zoologicum*, t. i. fasc. ii. p. 16, 1767.

² *Op. ante cit.*

³ *Proceedings of the Zoological Society*, 1832.

⁴ *Berlin. Jahrb. für d. Pharmacie*, 1818.

Stearine (<i>Talgsubstanz</i>)	1
Green resin, soluble in absolute alcohol	2
Odorous yellow substance, soluble in ordinary alcohol and in water	38
Brown substance, soluble in water	25
Insoluble residue (vegetable fibre, quartz sand, &c.)	34
	<hr/> 100

From his experiments, Schrader concluded that hyraceum was for the most part of an animal nature, very probably an excretion, and that its medicinal properties resided in its odorous yellow constituent, which dissolved both in spirit and in water. Its colour did not arise from the presence of blood, for he left a decoction of hyraceum exposed to the air for some weeks, without finding that it underwent putrefaction or any change of odour. It still retained the smell of Canadian castoreum, and had scarcely any effect on reddened litmus paper. By distillation with water, a distilled liquor was obtained, which had a feeble, faint, somewhat resinous odour, but no reaction on test paper. The minute quantity of urine, therefore, which it contained, must be regarded, like the sand and the vegetable substances, as an accidental impurity, although it is not impossible that these substances may be due to the admixture of animal excrement.

According to Paffe, it is produced by the uropoietical system. The hyrax drinks very seldom, if ever; and its urine, like that of the hare, is thick and glutinous. The animals secrete the urine at one spot, and by evaporation the tenacious extract sticks to the root. The fresh urine is reddish-coloured. Lehmann regards it as solid excrement. Reichel¹ analyzed hyraceum, and obtained twenty different substances, including castorin, uric acid, urea, as well as benzoic and hippuric acids; but Fikentscher says that he could not detect either of the last four substances; and he gives the following as the results of his analysis:—

Matter soluble in ether	11.5
Matter soluble in spirit of wine	38.0
Matter insoluble in both	19.1
Inorganic salts	31.4
	<hr/>
Hyraceum	100.0

TINCTURA HYRACEI (Martii).—R Hyraceum, powdered, ℥ij; Distilled Water ℥xviij. Digest at from 86° F. to 100° for eight days, frequently shaking. Filter, and to the solution add: Water, sufficient to make by weight, ℥xxj; Rectified Spirit ℥ij. Mix and filter. Dose, mxx to f℥j.

With regard to the medicinal qualities of hyraceum I have very little to say. My sample is too small to enable me to make any experiments with it. I believe it to be inert and useless; but it has been supposed to resemble castor in its nature, odour, and medicinal qualities. "The action of hyraceum," says Dr. Martiny, "is exactly the same as that of American castor, for which it may be substituted." But to say that hyraceum is equal to castor in medicinal properties is, I believe, to say little in its favour; for, in my opinion, there is no valid evidence that castor possesses any medicinal power whatever. Considered in an anatomical and physiological point of view, both castor and hyraceum possess some interest, but as therapeutical agents they are worthless. The remedial use of sexual and anal secretions and of excrements (*e.g.* castor, musk, civet, ambergris, album græcum, and hyraceum) belongs to the superstitious and absurd practices of a former age, and the administration of such disgusting and useless substances should be banished from scientific medicine.

It has been used in the form of powder, or of tincture.

[We subjoin an extract from an inaugural dissertation at Erlangen on this substance, by Fikentscher, found among the author's papers.—Ed.]

"In 1848," he says, "a selected specimen of the hyraceum was sent from the Cape to Professor Martius, who placed a part of it at the disposal of the Royal Hospital at Erlangen. Professor Canstatt, the distinguished theoretical and practical physician, submitted it to a careful trial, administering it to a great number of patients in the hospital, and obtained the best results. Professor J. Vogel reported that at the hospital of the University of Giessen, an application of this medicament had been made, at first, in small doses, without obtaining the results aimed at, but which failure was remedied by the administration of greater doses. As regards my own experience, I have already treated, in a space of two years, thirty three persons [the history of these cases the author has annexed in an appendix], thirteen of whom were hysterical persons, thirteen were subject to gastralgia, and one was an inveterate hypochondriac. Seven of them were treated with the tinct. hyrac. conjointly with other medicines; and twenty-six were treated with the tinct. hyrac. pure; all but eight of the latter were restored. The constricting pains in the region of the stomach, which ordinarily followed every use of food or of liquid—the headache, loathing, and vomiting—were diminished, and the appetite was restored. Other hysterical symptoms, as spasms, the peculiar globus hystericus, the nervous headache, palpitation, trembling of the members, to which thirteen individuals were before more or less subject, disappeared after the use of the tinctura hyracei, except in three persons.

¹ *Pharm. Central-Blatt für 1849.*

"To these, my own observations, I will add those of two of my friends: 'Dr. Wintrich, docent and assistant physician at the Polyclinik at Erlangen, has applied the tinctura hyracei (in doses of from one-half to one teaspoon) in cases of spasm, palpitation, hysteria, gastralgia, as well as in nervous excitements of irritable persons, altogether in thirty cases, and obtained good results. Dr. Meinel, at Roth, reported that he has made use of the tinct. hyrac. in cases of hysteria and of chlorosis, where a peculiar irritability of the nerves existed, and obtained very favourable results.'

"Finally, we conclude that the Tinctura Hyracei deserves to be recommended in most cases of irritability of the nervous system, in hysterical affections, and in gastralgia, *in doses of from one-half to one teaspoonful*. Every medical man knows well the difficulties which are presented in the treatment of hysterical persons: sometimes one is compelled to make use of the whole series of the so-called anti spasmodica, nervina, and anti-hysterica, in order to calm the patient; consequently, it must be satisfactory to be able to make use of a medicine which has been found to be efficacious in most, if not in all cases of this description."

[Since this was written, experience has not confirmed the very favourable description of the new drug here given. We are inclined to put the same value on it as that assigned by the author to album græcum, and other excrementitious articles. They are the relics of the superstitious practices of a bygone age.—Ed.]

APPENDIX.

THE METALLIC CYANIDES.¹

368. AURI TERCYANIDUM.—TERCYANIDE OF GOLD.

Formula AuCy³. Equivalent Weight 277.

THE directions for preparing this salt, in the French Codex, are somewhat diffuse. The process consists essentially in very carefully adding a solution of pure cyanide of potassium to a solution of chloride of gold, until a precipitate (*cyanide of gold*) ceases to be formed. The chloride of gold, prior to solution, should be deprived of all excess of acid by heating it in a salt-water bath.

Cyanide of gold is a yellow powder, which is insoluble in water. It has been used in venereal and scrofulous affections, both externally and internally. The dose is from one-fifteenth to one-tenth of a grain, made into a pill with some inert powder.

369. HYDRARGYRI PERCYANIDUM.—PERCYANIDE OF MERCURY.

Formula HgCy. Equivalent Weight 126.

HISTORY.—This salt was discovered by Scheele. Its real nature was first pointed out by Gay-Lussac in 1815. It has been known by various appellations, as *Prussian Mercury* (*Hydrargyrum Borussicum*), *Prussiate*, *Hydrocyanate*, *Cyanuret*, *Cyanide* or *Bicyanide of Mercury* (*Hydrargyri Prussias*, *Hydrocyanas*, *Cyanuretum*, *Cyanidum* seu *Cyanodidum*).

PREPARATION.—There are two methods of preparing this salt; one recommended by Proust, the other by Winckler. Proust's process was formerly adopted in two of the British Pharmacopœias.

The *London College* formerly ordered, of Percyanide of Iron [*Prussian Blue*] \mathfrak{z} viij; Binoxide of Mercury \mathfrak{z} x; Distilled Water Oiv. Boil them together for half an hour, and strain. Evaporate the liquor that crystals may be formed. Wash what remains frequently with boiling distilled water, and again evaporate the mixed liquor that crystals may be formed. The *Dublin College* employed of Prussian Blue *six parts*; Nitric Oxide of Mercury *five parts*; Distilled Water *forty parts*.

In this process the cyanogen of the Prussian blue combines with the mercury of the nitric oxide, while the iron unites with the oxygen of the oxide. Pure per-cyanide of mercury may be more economically prepared by Winckler's process. This consists in saturating hydrocyanic acid with red oxide of mercury. The solu-

¹ [It was announced by the author, in the preface to Vol. I of this edition, published in 1849, that the description of the various metallic cyanides should follow that of hydrocyanic acid. Since the announcement was made, the cyanides have been struck out of the London and Dublin Pharmacopœias. Nevertheless, we have thought it advisable to retain the author's account of these preparations, and we have therefore placed them in the Appendix.—Ed.]

tion is to be filtered and allowed to crystallize. In this process double decomposition takes place, the resulting products being water and peryanide of mercury.

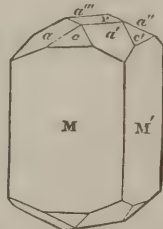
PROPERTIES.—The crystals of this salt are square prisms. They are heavy, white, colourless, transparent or opaque, inodorous, and have a strong metallic taste. They are soluble in water, both hot and cold, and very little, if at all so, in alcohol.

Fig. 442.



General Form of Crystals of Bicyanide of Mercury.

Fig. 443.



Crystals with Modified Planes.

CHARACTERISTICS.—Perfectly dry peryanide of mercury when heated yields metallic mercury and cyanogen gas. The latter is known by the violet or bluish-red colour of its flame. Heated with hydrochloric acid it evolves hydrocyanic acid. It is not decomposed by nitric acid or the alkalis. Its solution throws down a black precipitate with hydrosulphuric acid, and white pearly crystalline plates (*hydrargyro-iodo-cyanide of potassium*) with a concentrated solution of iodide of potassium.

[COMPOSITION.—Its composition is variously stated, according to the number assumed for the equivalent of mercury. The greater number of British chemists now consider it to be constituted of a single equivalent of each element, and therefore represented by the formula HgCy . The term Peryanide is given to it, in order to keep the nomenclature in conformity with that adopted by the author in the mercurial preparations of the first volume. There is no other cyanide of mercury known.—ED.]

PURITY.—When prepared from ferrosesquicyanide of iron (Prussian blue), the crystals are usually yellowish, from the presence of some oxide of iron. The following tests of its purity were published in the previous edition of the London Pharmacopœia:—

Transparent and totally soluble in water. The solution, when hydrochloric acid is added, emits hydrocyanic acid, which is known by its peculiar smell; and a glass moistened with a solution of nitrate of silver and placed over it, gives a deposit, which is dissolved by boiling nitric acid. By heat it emits cyanogen, and runs into globules of mercury.

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—It acts on plants like perchloride of mercury.¹

β. On Animals.—Coulon² found that it acted on dogs, cats, sparrows, frogs, snails, &c. like hydrocyanic acid. After death, inflammation of the stomach was observed. Ollivier d'Angers³ tried its effects on dogs. Seven grains, dissolved in water, killed a small dog in ten minutes, under attempts to vomit, general convulsions, and exhaustion, manifested alternately; respiration and circulation were at first accelerated, and afterwards diminished. Similar effects were produced by applying the salt to the cellular tissue, or injecting it into the veins. Tiedemann and Gmelin⁴ detected mercury in the blood of the splenic vein of a horse to which the peryanide had been administered.

¹ Goepfert, in De Candolle, *Phys. Vég.* 1834.

² *Traité sur l'Acide Prussique*, quoted by Wibmer, *Wirk. d. Arzneim.* iii. 30.

³ *Journ. de Chim. Méd.* i. 269.

⁴ *Versuche üb. d. Wege auf welch. Subst. aus d. Magen u. Darmk. ins Blut. gelang.*

γ. On Man.—Taken in *small doses*, it very readily excites nausea and vomiting. Parent¹ says it does not produce the epigastric pain which the perchloride of mercury readily occasions. Continued use causes salivation. In one case, one-eighth of a grain twice a day caused ptyalism in three days.² Mendaga³ says it acts directly on the skin and bones, and hence it sometimes very speedily allays the pain of and disperses nodes.

In *large doses*, especially in very susceptible persons, it affects the nervous system, and causes fainting, anxiety, and cramps. Twenty-three and a half grains in one instance⁴ caused death in nine days. The most remarkable symptoms were: obstinate vomiting; mercurial ulceration of the mouth, and abundant ptyalism; contractions of the heart, which at first were very strong, but became successively slower and more feeble; the abdomen was yielding, and not tender, notwithstanding the constant tenesmus; suppression of urine; semi-erection of the penis, and ecchymosis of this organ, as well as of the scrotum; and, ultimately, convulsive movements.

USES.—It has been employed as an *antivenereal* medicine, and was first used as such by Brera.⁵ Parent⁶ administered it as a substitute for the perchloride of mercury, over which it has several advantages. Thus, being more soluble, it ought to be more readily absorbed; it does not give rise to epigastric pain; and lastly, it is not so readily decomposed; for alkalies, several salts, and many solutions of organic matters, which decompose corrosive sublimate, have no effect on it. It may be applied in the form of aqueous solution or ointment to venereal sores.

It has been employed in induration of the liver, in some chronic skin diseases, in obstinate headache, and in other maladies, as an antiphlogistic.

Its principal use in this country is as a source of hydrocyanic acid and of cyanogen gas.

ADMINISTRATION.—Internally, it may be employed in doses of one-sixteenth of a grain gradually increased to one-half of a grain. It may be administered in the form of pills (made with crumb of bread) or in alcoholic solution. It will be frequently advisable to conjoin opium, to prevent nausea or vomiting. When used as a *gargle* or *wash*, we may employ ten grains to a pint of water. An *ointment* may be prepared of ten or twelve grains to an ounce of lard.

ANTIDOTE.—I am unacquainted with any antidote for it. Albumen does not decompose it. Perhaps ammonia might be found serviceable, to diminish the effect on the nervous system. Opium relieves the vomiting. Our principal object must be to remove the poison from the stomach, which is to be effected by the stomach-pump, emetics, tickling the throat, &c.

370. ARGENTI CYANIDUM.—CYANIDE OF SILVER.

Formula AgCy. *Equivalent Weight* 134.

HISTORY.—This compound, sometimes called *Hydrocyanate*, *Cyanuret*, or *Cyanodide of Silver*, or *Argentum zootinicum*, has been studied by Scheele, Ittner, and Gay-Lussac.

PREPARATION.—In the *London Pharmacopœia* it was formerly directed to be prepared as follows:—

Take of Nitrate of Silver $\mathfrak{z}\text{ij}$ and $\mathfrak{z}\text{ij}$. Diluted Hydrocyanic Acid, Distilled Water, each Oj. Dissolve the Nitrate of Silver in the Water, and add to them the diluted Hydrocyanic Acid, and mix. Wash what is precipitated with distilled water, and dry it.

In this process, one equivalent or 27 parts of hydrocyanic acid react on one equivalent or 170 parts of nitrate of silver; thereby generating one equivalent or

¹ *Journ. de Chim. Méd.* viii. 473.

² Neumann, in Dierbach's *Neuesten Entd. in d. Mat. Méd.* ii. 483, 1828.

³ *Decades Medico-chirurgicas y Farmaceuticas*, vi. 319, in Richter's *Ausführ. Arzneim.* v. 477.

⁴ *Journ. de Chim. Méd.* i. 210.

⁵ *Journ. de Chim. Méd.* viii. 473.

⁶ Richter, *op. cit.*

134 parts of cyanide of silver, and one equivalent or 9 parts of water, and setting free one equivalent or 54 parts of nitric acid.

PROPERTIES.—When first thrown down it is a curdy precipitate, which by drying becomes pulverulent. It is insipid, insoluble in water, but dissolves in caustic ammonia. It is decomposed by hydrochloric and hydrosulphuric acids, both of which develop with it hydrocyanic acid. It combines with other metallic cyanides to form the *argento-cyanides*. By exposure to the atmosphere and solar rays it slowly assumes a violet tint. It is slowly decomposed by mixture with neutral vegetable substances.¹

CHARACTERISTICS.—It is insoluble in cold nitric acid, but soluble in the boiling acid. When carefully dried and then heated in a glass tube, it yields cyanogen gas (which is readily known by its combustibility and the bluish-red colour of its flame) and a residuum of metallic silver. The latter is recognized by the before-mentioned tests for this metal.

COMPOSITION.—The following is the composition of this substance :—

	Atoms.	Eq. Wt.	Per Cent.
Silver	1	108	80.60
Cyanogen	1	26	19.40
Cyanide of Silver	1	134	100.00

PHYSIOLOGICAL EFFECTS AND USES.—I am unacquainted with any experiments made to determine its effects on man and animals. Serre, of Montpellier,² gave it in syphilitic maladies, in doses of one-tenth and even one-eighth of a grain, without the least inconvenience. It was introduced into the London Pharmacopœia, at the suggestion of Mr. Everitt, as a source of hydrocyanic acid, but it has been excluded from the last edition.

371. ZINCI CYANIDUM.—HYDROCYANATE, CYANIDE, OR CYANURET OF ZINC.

Formula ZuCy . *Equivalent Weight* 59.5.

This salt was introduced by the German physicians, as a substitute for hydrocyanic acid. It is prepared by adding recently-made oxide of zinc to hydrocyanic acid; or by adding a solution of sulphate of zinc to a solution of cyanide of potassium. It is a white powder, insoluble in water or alcohol. If a strong mineral acid be added to it, hydrocyanic acid is developed, and a soluble salt of zinc obtained. The latter is recognized by the tests before mentioned for a solution of zinc. It consists of one equivalent or 32 parts of *Zinc*, and one equivalent or 26 parts of *Cyanogen*.

Its effects have not been carefully ascertained, but they are supposed to be similar to those of hydrocyanic acid. It has been used principally in affections of the nervous system, as epilepsy, hysteria, and chorea. It has also been employed in cardialgia and cramps of the stomach, and as an anthelmintic in children. The dose is a quarter of a grain to a grain and a half, three times a day. It may be taken in the form of powder mixed with calcined magnesia.

¹ *Journ. de Chim. Méd.* 2nde sér. iii. 407.

² *Medico-Chirurgical Review*, July, 1840.

372. RADIX SUMBUL.—SUMBUL ROOT.

SUMBUL,¹ SAMEUL, MUSK-ROOT.(Racine de Sambola ou Sambula, *Guibourt*.²—Moschus-wurzel of the Germans.)

This drug was introduced into Germany from Russia about the year 1840; more recently, it has been brought under the notice of the medical profession in England.³

The botanical origin of Sumbul root is involved in obscurity; from a resemblance which it bears to Angelica, there is reason to think it is afforded by some nearly allied umbelliferous plant. It has been supposed a native of Persia; but we think there is greater reason to conclude that it is produced in some of the more remote regions of Central Asia. Dr. Granville states that it is brought into the Moscow drug-market by way of Kiakta.

Two varieties of Sumbul have appeared in English commerce, viz:—

1. **Russian Sumbul Root** (*Radix Sumbul Muscovitici*).—The Sumbul imported from Russia occurs in nearly circular pieces, formed by the transverse section of a large root; these pieces, which have a dirty, somewhat worn appearance, are from about $2\frac{1}{2}$ to 5 inches in diameter, and from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches in thickness at the edge, which, owing to unequal contraction in drying, is thicker than the central portion. On the outer edge they are covered with a dusky, brown, rough bark, frequently beset with short bristly fibres; the interior consists of a spongy, coarsely fibrous, dry, yellowish-white mass, of a somewhat farinaceous appearance. Some pieces, constituting the crown portion of the root, are covered with a papery bark. The root has a pure musky odour. Its taste is rather bitter, and very slightly acid.

2. **Indian Sumbul Root** (*Chinese Sumbul Root?*); *Radix Sumbul Indici*.—A second variety of Sumbul root has been imported into England from Bombay. It is stated to be of closer texture, firmer, denser, and of a more reddish tint than the Russian sort. Some of the pieces are said to bear a slight resemblance to inferior rhubarb. In odour it is perhaps less powerful than the Russian.⁴

Sumbul root has also been brought to England *via* China. A sample in our possession, said to have been thus obtained, is in smoothly cut slices, having the cut surface of a dusky yellow or reddish-brown, surrounded with a paler zone. The external thin bark has been mostly peeled off, leaving visible a pale yellow inner bark. The pieces, which, from their regular edges, appear to have been cut from a dried root, are smaller than those of the Russian sumbul, denser, and sometimes of an almost unctuous aspect. The odour resembles that of the Russian sumbul, though rather weaker; the taste is bitter, and slightly suggestive of ammoniacum. Judging from the description of Indian sumbul root given in the *Pharmaceutical Journal*,⁵ this variety is identical with it.

Sumbul root has been analyzed by several German chemists,⁶ the results of whose investigations show it to contain a volatile oil; two balsamic resins, one soluble in ether, the other in alcohol; wax, starch, &c. In addition to these, a crystallizable acid has been obtained in minute quantity by Dr. Reinseh, and named by him *Sumbulic acid*.

Sumbul root may be administered, in substance, in doses of from grs. iij to grs. viij; in tincture, made by digesting for seven days \mathfrak{z} ij of the root in \mathfrak{z} xvj of proof spirit.⁷ An ethereal tincture is likewise employed, as may be also, according to

¹ The Arabic word, *Sumbul*, signifying an ear or spike, has been applied to several odoriferous drugs, as, e. g. to the true spikenard, *Nardostachys Jatamansi*, De Cand., the *Sumbul Hindee* or *Indian Sumbul* of the East; see Sir William Jones *On the Spikenard of the Antients*, in the *Asiatic Researches*, ii. 405, iv. 111, Lond. 1799; also Richardson's *Persian, Arabic, and English Dictionary*, word *Sumbul*, i. 544, Lond. 1806.

² *Hist. des Drogues*, 4ème édit. iii. 195.

³ See *The Sumbul, a New Asiatic Remedy*, by A. B. Granville, M. D. Lond. 1850.

⁴ *Pharmaceutical Journal and Transactions* for Feb. 1852, xi. 358.

⁵ Vol. xi. p. 358.

⁶ *Pharmaceutical Journal and Transactions*, xi. 144.

⁷ Quoted in *Journ. de Pharm.* xix. 278, 1851.

Dr. Granville, an aqueous infusion, decoction, or extract. The alcoholic tincture may be given in doses of from \mathfrak{m}_{xx} to \mathfrak{m}_{lx} .

[NOTE.—We subjoin a list of some papers published by the author in the *Pharmaceutical Journal* since the previous edition of his work. They will be found to contain many subjects of interest in addition to those noticed in these volumes.]

1. On the Colouring Matter of Dutch or Cake Litmus. Vol. IX. No. 1; also Vol. X. No. 9.
2. On Socotrine Aloe Juice. Vol. XI. No. 10.
3. On the Cardamoms of Abyssinia. Vol. VI. No. 10.
4. On Grains of Paradise. Vol. II. No. 7.
5. On some Rare Kinds of Rhubarb. Vol. IV. No. 10.
6. Some Observations on Potato Starch. Vol. III. No. 1.
7. The Varieties of the Almond. Vol. VI. No. 5.
8. On the Myrospermum of Sonsonate. Vol. X. No. 8. [Dr. Royle has proposed to call this after the author, *Myrospermum Pereiræ*].
9. On the Black Balsam of Peru. Vol. XI. No. 5.
10. On the Plants from which Senna Leaves are obtained. Vol. IX. No. 1.
11. On Xyloidine, or Gun-Cotton. Vol. VI. No. 5.
12. On Mishmee Bitter, or Coptis Teeta. Vol. XI. No. 7.
13. On the Flower Buds of Calysaccion Longifolium. Vol. X. No. 9.
14. Notice of some Vegetable and Animal Substances, Natural Products of New Granada. Vol. XI. No. 6.
15. On the *Ægle* Marmelos, or Indian Bael. Vol. X. No. 6.

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